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ABSTRACT

The second phase of a two-phase study evaluated (through 24 care studies in California, Missouri, Illinois, and New York) the feasibility of implementing an evaluation model of workplace-based retraining programs developed during the first phase of the project in California. The feasibility study addressed two components of an evaluation system: (1) business selection and screening guidelines; and (2) performance assessment based on four types of performance outcome measures--company performance, work-unit performance, skill competencies, and wages and earnings. The study found the following: (1) the proposed evaluation system is consistent with widely recognized models of business training design and evaluation for training projects that are intended to improve business performance; (2) company performance indicators can be easily identified and measured in valid and reliable ways without imposing extra costs; (3) the seven screening guidelines can effectively address the most important targeting and substitution problems faced by state programs; and (4) the proposed evaluation system can be administered effectively without substantial costs being incurred by either the businesses or the program. The feasibility study concluded that state training grants are effective in expanding training opportunities and that an evaluation system can be implemented successfully. (Summaries of 24 case studies make up most of the document. They contain information on the following: training grant, focus of case study, overview of company, competitive problems, strategic and operational objectives, company performance measures, need for retraining, training program, need for state assistance, performance outcomes, training outcomes, and observations.) (KC)

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EVALUATING STATE-FINANCED, WORKPLACE-BASED RETRAINING PROGRAMS:

Case Studies of Retraining Projects

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A Joint Study of the
National Commission for Employment Policy
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EVALUATING STATE-FINANCED, WORKPLACE-BASED RETRAINING PROGRAMS:

Case Studies of Retraining Projects

Research Report 91-05

April 1992

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The opinions expressed in this paper are those of the authors and do not necessarily reflect the opinions of the members and staff of the National Commission for Employment Policy, the National Governors' Association, and the organizations and agencies participating in this study.

■ PREFACE

This report is divided into two volumes. Volume I describes the proposed business screening and performance outcome evaluation system, our findings regarding the feasibility of the system, and our recommendations for implementation. Volume II is a compendium of 24 case studies that were done to test the feasibility of the screening and evaluation system. They also illustrate the variety of retraining investments made by state governments and provide practical lessons for designing successful retraining efforts.

ACKNOWLEDGEMENTS

This project on state-financed, workplace-based retraining programs was accomplished only through the help and cooperation of many individuals and agencies. The idea for the project was initiated by Kris Coryell, then Chief Executive Officer of Illinois' Prairie State 2000 Authority, and her Board who recognized that the training assistance program operated by the agency posed a unique set of methodological issues for screening and evaluating retraining grants to businesses. She was joined soon by the California Employment Training Panel and Steve Duscha, then Executive Director.

The National Governors' Association gave the project a home by agreeing to sponsor and manage the effort. Evelyn Ganzglass, who managed the project for NGA, provided direction and guidance throughout. She was assisted ably by Debbie Woods.

The National Commission for Employment Policy, enthusiastically supported this project, both in terms of financial assistance and through the able management of Kay Albright, Steve Baldwin, and Carol Romero.

Of course, none of the work could have been done without the full support and assistance of the directors of the agencies participating in the study: James Bratt, California Employment Training Panel; Peter Mannella, New York Economic Development Skills Training Program; and Michael Hartmann and Larry Earley, Missouri Customized Training Program. The study also was supported and guided by an Advisory Committee of highly regarded experts in employment and training issues: Anthony Carnevale, American Society for Training and Development; Ralph Smeda, American Bankers' Association; Susan Herrenbruck, American Gear Manufacturers Association; Ken Edwards, International Brotherhood of Electrical Workers; Markely Roberts, AFL-CIO; John Robinson, Motorola; Jeff Zornitsky, Abt Associates; and Patricia Buckley, Machinery and Allied Products Institute. We were assisted, in particular, by the considered and well-crafted criticism of Dr. John Bishop, Cornell University, and Dr. David Stevens, now at the University of Maryland and previously at the University of Missouri.

We also received enormous cooperation from the 24 companies participating in the study. In particular, we very much appreciate the help of Gary Goode, Unicadd; Frank Rausa, Northwestern Steel and Wire Co.; Randal Lawrence, Lawrence Box & Basket Co.; Reggie Greenwood, KLM; Paul Toboldt, Ingersoll Milling Machine Co.;

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■ EXECUTIVE SUMMARY

Since the 1960s, states have created customized training programs as part of their economic development efforts to attract, expand, and retain businesses. Unlike traditional employment and training programs that focus on individuals and specific target populations, state-financed customized training programs are mainly economic development programs. They emphasize business training needs and the use of state training funds in increasing and retaining jobs for the state. Most recent studies estimate that 46 states now have one or more customized training programs.

State-financed, customized training programs emerged in the 1960s and 1970s as part of state efforts to attract new businesses to the state and promote employment expansion in existing businesses. These state programs focused on training unemployed or newly hired workers for new jobs. State-financed, workplace-based retraining programs, that is, programs that focus on business retention and the retraining of existing employees are a phenomenon of the 1980s. During the last decade, business retention and employee retraining have become significant components of most customized training programs.

State-financed, workplace-based retraining programs have been established on the assumption that the most effective way to address unemployment problems in states is to prevent them in the first place. These programs are operated with the mandate to minimize the incidence of unemployment and retain jobs by retraining employees who are at risk of losing their jobs because of changing skill requirements in the workplace.

The increased emphasis on business retention and employee retraining is a response to a broad array of industry and labor force changes. It is also a response to the growing demands of in-state businesses for the same types of training assistance provided to new and expanding businesses.

Growing business interest in retraining programs and the resulting demands for more public funds have raised important policy questions about the role and effectiveness of state-financed, workplace-based retraining programs in state economic development efforts. Critics of these programs argue that there is no clear policy rationale and intervention model that explain how these programs will retain jobs and minimize unemployment. They argue that there is no formal evaluation system for assessing whether retraining is effective in reaching these objectives. In addition, they argue that training funds are given to companies that would have retrained their employees without government assistance. In other words, public funds merely are substituted for company funds which would have been spent for retraining even without the involvement of state programs.

As state-financed, workplace-based retraining programs grow and mature, it is reasonable to assume that these policy and evaluation issues will become more important to state policy-makers. It is likely that in the near future state agencies will be required to evaluate the effectiveness of their training investments in reducing unemployment and retaining jobs.

Phase One

The first objective of this project was to clarify the policy rationale and intervention model for state-financed, workplace-based retraining programs in terms of their twin objectives of retaining jobs and preventing unemployment. The second objective was to develop an evaluation system for these programs that was comprised of:

- **Business screening guidelines** for targeting training investment and minimizing substitution effects.
- **Performance outcome system** for measuring program outcomes that are necessary to achieve these two program objectives.

In phase one, the project developed a policy rationale and intervention model for these programs based on a review of two programs--California's Employment Training Panel and Illinois' Prairie State 2000 Authority. Ideally, state-financed, workplace-based retraining programs are designed to reduce unemployment and retain jobs by:

- **Improving business performance** and the competitive standing of the business within its industry.
- **Providing marketable skills** to retrained workers.

Because of their strong economic development focus, these programs put their major emphasis on improving business performance. They are based on the assumption that employee retraining reduces the incidence of unemployment and retains jobs by improving the productivity of workers. In turn, worker productivity is a function of both worker skills and the integration of these skills into a productive workplace that incorporates appropriate process technologies, job design, labor-management relations, compensation systems, and employment security policies. To be successful, employee retraining must be integrated with larger workplace changes that are intended to improve work unit or company performance.

However, state-financed, workplace- based retraining programs, as employment and training programs, should minimize the likelihood of future unemployment of retrained workers by helping them gain marketable skills. In some cases, retraining projects will not be associated with improvements in business performance. By establishing the attainment of marketable skills as a condition, state programs provide retrained workers with an additional assurance that future unemployment will be minimized as a result of their participation in the retraining project.

In combining both company performance and workers' skills as basic conditions, a successful training project is expected to result in the following performance outcomes (see Figure 1, Chapter 2):

- **Training (Behavioral) Objectives.** Retrained workers have attained behavioral skill objectives that are designed to improve work unit or company performance and enhance the employment opportunities of workers outside the company.
- **Work Unit Performance.** Worker retraining is associated with improved performance of the work units that participated in the training project.
- **Company Performance.** Worker retraining and associated improvements in work unit performance are related to improvements in company performance.
- **Trainee Earnings.** Worker retraining results in stable or improved employment and earnings for retrained workers.

Based on this intervention model, the first phase of the project also developed business screening guidelines that would maximize the effects of training projects on program objectives and minimize substitution problems. The screening guidelines were based on the assumption that retraining projects will have their greatest effect when:

- Worker retraining is integrated into larger company plans to improve company performance and maintain or enhance its competitive standing within its industry.
- Worker retraining is a critical factor in improving company per- formance because of significant changes in skill requirements.
- Retraining provides workers with transferable skills that are likely to be in high demand in their respective labor markets.
- Businesses are unlikely to undertake the retraining without outside intervention such as government assistance.

Seven screening guidelines were developed from these assumptions. As shown in Figure 2 (Chapter 2), these seven guidelines included three guidelines addressing company strategies and performance objectives and skill requirements. The remaining four guidelines addressed substitution screening.

These business screening guidelines and the four performance outcome objectives constituted the formative evaluation model that was assessed in phase two of the project. The evaluation model is presented in Figure 3 (Chapter 3).

Phase Two

The second phase of the study addressed the feasibility of implementing the evaluation model in four state-financed, workplace-based retraining programs. These programs were: (1) California's Employment Training Panel, (2) Illinois' Prairie State 2000 Authority, (3) Missouri's Customized Training Program, and (4) New York's Economic Development Skills Training Program. The feasibility study was based on 24 case studies of training projects funded by the four state programs. The study also involved related research activities on business training and evaluation practices and the availability of necessary industry and labor market information.

This second phase addressed four major feasibility questions. The findings on each feasibility question are summarized below.

- **Business Training Design and Evaluation**. Is the system compatible with business practices in training design and evaluation?

The proposed evaluation system is consistent with widely recognized models of business training design and evaluation for training projects that are intended to improve business performance (see Figure 4, Chapter 4). The evaluation system is consistent with what many training and development professionals recommend is the most appropriate way for businesses to plan and evaluate their own training investments. The only major difference between the evaluation model and recommended business practice is the model's emphasis on trainee earnings.

- **Definition and Measurement of Performance Outcomes**. Can the four performance outcome indicators (company performance, work unit performance, training objectives, and trainee earnings) be measured in a valid and reliable manner that is consistent with business performance measures and data collection activities?

The case studies of 24 training projects in the four state programs suggest that company or work unit performance outcome indicators can be easily identified and measured in valid and reliable ways that are consistent with the methods that businesses use to measure their own performance. Consequently, these company or work unit performance measures should not impose extra costs on businesses because businesses normally collect the same information for their own internal purposes.

Also, we conclude that company and work unit performance are best measured in terms of operational objectives and performance targets that are logically linked to business strategies and performance goals (see Figures 5 and 6, Chapter 4). The case studies identified seven major types of operational objectives and performance targets that could be linked to competitive strategies and business goals as well as financial and market performance.

The definition and measurement of training objectives varied widely in the 24 case studies. However, we conclude that all 24 companies could have restructured their training curricula in terms of measurable training or behavioral objectives. Although this requirement would require additional effort from most companies, it is consistent with widely accepted standards of business training design. The benefit of this additional effort is more effective training projects.

Because of validity and reliability problems in employee testing, we conclude that post-testing requirements should be established. They should be simple and easy to measure and should address behavioral skills directly related to a core set of training objectives.

The use of trainee earnings as a major performance outcome indicator has significant problems because of the wide variation in company compensation systems. It still is useful to track and report the employment and earnings experiences. Data collection costs for businesses as well as state programs can be minimized by using Unemployment Insurance (UI) wage records.

- **Business Screening Guidelines.** Can the evaluation system practically address targeting and substitution problems through a set of business screening guidelines?

Other substitution problems can be addressed through state contractual and in-kind policies that pay for the type of training that companies ordinarily do not undertake on their own initiative. Typically, these training activities include classroom and laboratory training and highly structured on-site training.

The seven screening guidelines can effectively address the most important targeting and substitution problems faced by state programs. Based on the 24 case studies, we found that companies can clearly state competitive strategy (e.g., cost, quality, differentiation), performance objectives, and the need for retraining. In most cases, they can cite industry benchmarks that they must meet to remain competitive. Industry information on competitive benchmarks is available to state programs. They may use this information to work with companies in defining meaningful performance objectives.

In addition, most companies can define training objectives and retraining requirements. The only possible exception is some small companies. State programs can establish simple and inexpensive procedures to establish the marketability of the skills acquired through training projects. Although the substitution guidelines are more difficult to implement, they will be effective in reducing some substitution problems faced by state programs.

The seven screening guidelines can be incorporated effectively into a simple application process that would not require substantial extra work for either businesses or state program staff. The application process and the screening guidelines are summarized and illustrated in Figures 7 and 8 (Chapter 5).

- **Implementation of the Evaluation System.** Can the evaluation system be implemented effectively given the administrative budgets of state programs and the background and training of staff? Would businesses continue to participate in the program?

The proposed evaluation system can be administered effectively without substantial additional costs being incurred by either the business or the program. In order to implement the system, additional staff training will be required. This staff training will be necessary in order to standardize the method for reporting business performance objectives. Most state staff are trained sufficiently in identifying clear training objectives.

Future business participation is difficult to assess. However, no business voiced objections over specifying business performance objectives or training objectives in future proposals. We propose a simplified application process where each screening and performance outcome issue can be addressed effectively without causing a significant increase in the requirements of the current application procedures now utilized by any of the four state programs participating in the project.

This feasibility study resulted in six major conclusions on the effects of state-financed, workplace-based retraining programs:

1. State training grants generally will expand the scope, shorten the timing, and enlarge the number of workers who participate in training projects.

2. Training projects were most effective when they tied clearly to specific business goals and performance objectives and when the training plan defined clear training or behavioral objectives.

3. State training grants have an important value in overcoming management uncertainty over the importance of retraining workers for the introduction of new technologies and work processes.

4. Substitution risks are lowest when state grants concentrate on the direct instructional costs of classroom and laboratory training.

5. In many cases, company management, especially in small businesses, was uncertain about how to utilize training as an effective agent of strategic change to improve company performance.

6. State programs may play a major catalytic role in encouraging businesses to use training as an agent of strategic change and establish permanent learning systems within companies.

These major findings and conclusions from the feasibility study provide the basis for five recommendations.

1. States should adopt the business screening and performance outcome evaluation system as the basis for a more detailed formative evaluation system worked out by each state in conformance with program statutes, policies, and contracting practices.

2. States should establish multi-stage projects that recognize that training may involve multi-year efforts. However, each stage should have intermediate training or performance objectives with all stages justified in terms of final business goals and performance objectives.

3. States should establish special technical assistance programs that would improve access for small businesses to retraining programs. These programs should provide technical assistance in defining competitive strategies and performance objectives as well as training objectives and training design.

4. State programs should implement the formative evaluation system over a two-year implementation period.

- **Year 1** - Implementation of business screening and performance outcome system with: a) an evaluation of the effects of system implementation on program operation including business participation, application screening, and contract management, and b) case studies of a representative sample of training projects on company performance and training objectives.
- **Year 2** - Refinement of business screening and performance outcome system with a formal follow-up study of a representative sample of training project on company performance, training objectives, and trainee earnings based on unemployment insurance (UI) wage records.
- **Year 3** - Implementation of the full follow-up system based on a representative sample of training projects and the implementation of a system to track trainee earnings based on Unemployment Insurance (UI) wage records.

5. Federal and state governments should cooperate in establishing a resource center for disseminating information on state-funded training projects and their role in improving the competitiveness of industry. The resource center also should provide models of comprehensive training systems that combine basic, occupational, and job-specific training.

■ CHAPTER 1

Introduction and Overview

In 1987, California's Employment Training Panel and Illinois' Prairie State 2000 Authority identified a common need to develop a formal evaluation system for their business retention and employee retraining projects. Given the growing business interest in retraining and the emerging evaluation issues in state employment and training and economic development programs, these agencies recognized that they would require a more fully developed evaluation system in the future.

Based on the evaluation questions raised by these agencies, the National Governors' Association organized a study to develop and assess an evaluation system for state-financed, workplace-based retraining programs. Through funding from the National Commission for Employment Policy (NCEP), the National Governors' Association sponsored a two-phased project. The first phase was a study of the policy and evaluation issues for state-financed retraining programs and the development of an evaluation approach that could be assessed and refined through a comparative state study of retraining projects. This resulted in a NCEP report entitled State-Financed, Workplace-Based Retraining Programs (Creticos and Sheets, 1989). This report proposed a formative evaluation approach that was consistent with the policy rationale and performance objectives of state-financed, workplace-based retraining programs.

The second phase of the project was designed as a feasibility study of the evaluation approach based mainly on case studies of 24 retraining projects in four state programs. The four state programs participating in the second phase were:

- California's Employment Training Panel
- Illinois' Prairie State 2000 Authority (Employer Training Assistance Program)
- Missouri's Customized Training Program
- New York's Economic Development Skills Program

The feasibility study in phase two of the project was designed to address two important components of an evaluation system: (1) business selection and screening guidelines; and (2) performance assessment based on four types of performance outcome measures - company performance, work-unit performance, skill competencies, and wages and earnings. The conclusions from this feasibility were presented in a second NCEP report entitled Evaluating State-Financed, Workplace-Based Retraining Programs: A Report on the Feasibility of a Business Screening and Performance Outcome Evaluation System (Creticos and Sheets, 1990).

This report on the feasibility of the proposed evaluation system was based in part on the 24 case studies of training projects funded by the four state programs. Summaries of these case studies are presented in this second volume. Chapter 2 provides a summary of the evaluation components that were addressed directly through the case studies. Chapter 3 provides summaries of the 24 case studies. These summaries focus on the linkage between retraining and company and work-unit performance objectives. A short description of business sampling and case study methodology are provided in Appendix A.

■ CHAPTER 2

The Evaluation Model: Linking Retraining to Company and Work-Unit Performance

The comparative state feasibility study addressed whether it was possible to develop and implement a formative evaluation system which included two major components: (1) business application and screening guidelines, and (2) performance outcomes (Creticos and Sheets, 1990). The case studies addressed all aspects of the proposed system (Figure 1). They addressed whether businesses could develop short and concise applications containing information on competitive problems and major strategic and operational objectives, retraining needs, training objectives and skill competencies, and the need for state assistance. They also addressed whether states could develop and apply screening guidelines for maximizing economic impact and reducing substitution costs. Finally, they addressed whether businesses and state programs could actually measure the achievement of major performance outcomes after training. These performance outcomes were company performance, work-unit performance, skill competencies, and wages and earnings.

The most important aspect of both the business screening and performance outcome components of the proposed evaluation system is the linkage between retraining efforts and the achievement of company or work-unit performance objectives (Creticos and Sheets, 1990). State financed, workplace-based retraining programs are mainly economic development programs which serve the training needs of businesses. The foundation of the evaluation system was based on the assumption that state programs were successful in preventing unemployment and retaining jobs when retraining projects together with other actions were successful in improving the competitive standing of the company (Creticos and Sheets, 1989).

The major purpose of the case studies was to assess whether state programs could establish the linkage between retraining and company and work-unit performance in both their screening guidelines and performance outcome evaluations. In addressing the screening guidelines, the case studies focused on describing the competitive challenges faced by businesses and how these competitive pressures were linked to measureable performance objectives at the company and work-unit levels. In addressing performance outcomes, the case studies focused on how companies measure and track performance objectives as part of their retraining efforts. This linkage was a major consideration in selecting a representative group of businesses in the four states and in developing the case study methodology (See Appendix A).

The feasibility study which was based in part on these case studies concluded that training projects were most effective when they were tied clearly to specific business goals and performance objectives and when the training plan defined clear training objectives and skill competencies (Creticos and Sheets, 1990). It concluded that company or work-unit performance outcomes can be easily identified and measured in valid and reliable ways that are consistent with how businesses measure their own performance. As shown in Figure 2, company and work-unit performance are best measured in terms of operational objectives and performance targets that are logically linked to business strategies and performance goals (Creticos and Sheets, 1990). Although Figure 2 addresses manufacturing companies, the 24 case studies also provide clear illustrations of how the framework can be applied to service industries including retail trade, business services, and finance and banking.

■ CHAPTER 3

Case Studies of Retraining Projects

The following summaries of the 24 case studies were developed to provide a feneral overview of each retraining project with special focus on the linkage between retraiing and company performance objectives. The summaries of the 24 case studies include the following sections:

1. **Training Grant** - short overview of the training grant given to the company or the grant recipient (e.g., community college).

2. **Focus of Case Study** - the part or stage of the total retraining project which was addressed in the case study.

3. **Overview of Company or Industry Receiving the State assistance** - description of the organizational structure and major products and services of the company receiving the training assistance.

4. **Competitive Problems Faced by the Company or Industry** - description of the competitive challenges faced by the company and their industry which require the company to make major internal changes.

5. **Strategic and Operational Objectives** - description of the major strategic and operational objectives of the company in response to competitive problems.

6. **Possible Company Performance Outcome Measures** - definitions of possible measures for the key operational objectives defined by the company.

7. **Need for Retraining and Training Objectives** - description of why employees need retraining to remain employed at the company and the major training objectives for the retraining project.

8. **Training Program** - overview of the training program funded by the state grant including major training modules and what types of training and training providers were used.

9. **Need for State Assistance** - rationale for state assistance and a summary of the perceived impact of state assistance from the company perspective.

10. **Performance Outcomes** - summary of the measurable effects of the training program (and related company actions) on the company performance objectives.

11. Training Outcomes - description of how the company conducted pre- and post-testing of trainees on the major training objectives and skill competencies established by the company.

12. Observations - general observations made by the researchers on the major strengths or unique features of each retraining project.

The following case summaries contain all 12 sections. However, these summaries differ substantially in the types and amount of information in each section. These differences exist because of two major reasons. First, case studies were selected and used for many different purposes. In some cases, we focused more on company performance objectives. In other cases, we focused on training objectives and measuring skill competencies. Second, although all companies participating in the study were cooperative, we were not successful in every instance in conducting all the necessary interviews and gathering all of the necessary background and performance information. However, all case summaries have been prepared to address the linkage between retraining projects and company performance objectives.

Figure 1
Business Application, Screening Guidelines, and Performance Outcomes for State Evaluation Systems

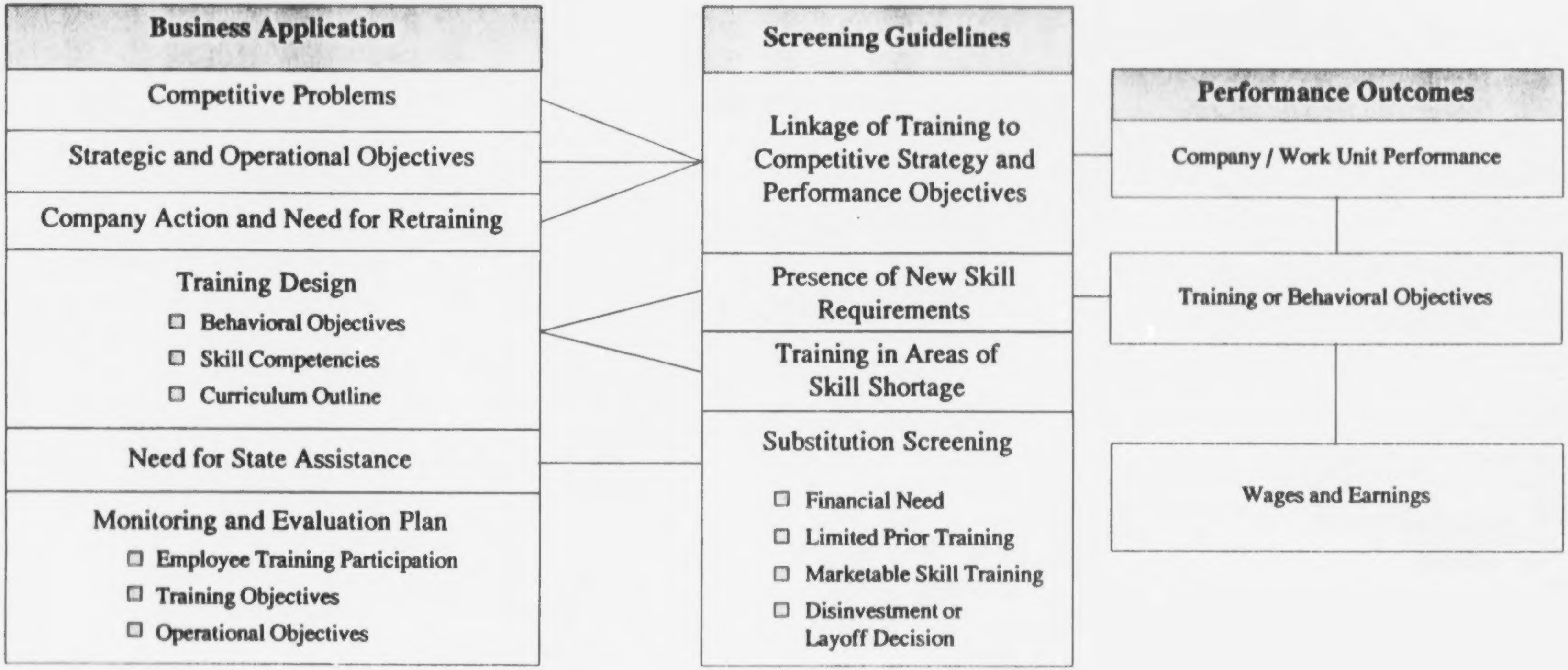
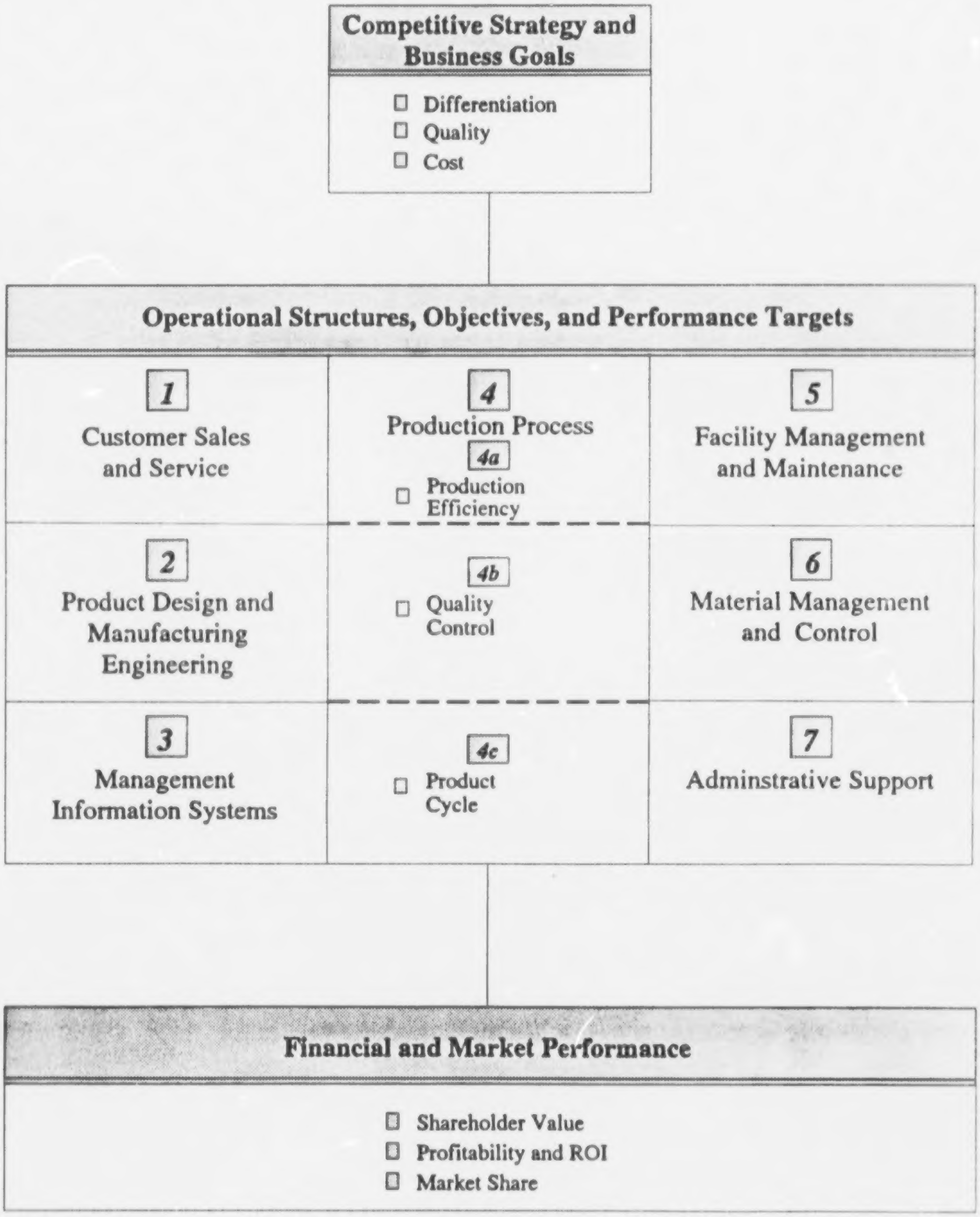

Business Application
Competitive Problems
Strategic and Operational Objectives
Company Action and Need for Retraining
Training Design
☐ Behavioral Objectives
☐ Skill Competencies
☐ Curriculum Outline
Need for State Assistance
Monitoring and Evaluation Plan
☐ Employee Training Participation
☐ Training Objectives
☐ Operational Objectives
Screening Guidelines
Linkage of Training to Competitive Strategy and Performance Objectives
Presence of New Skill Requirements
Training in Areas of Skill Shortage
Substitution Screening
☐ Financial Need
☐ Limited Prior Training
☐ Marketable Skill Training
☐ Disinvestment or Layoff Decision
Performance Outcomes
Company / Work Unit Performance
Training or Behavioral Objectives
Wages and Earnings

Figure 2

Evaluation Framework for Company/Work Unit Performance Objectives


Competitive Strategy and Business Goals
☐ Differentiation
☐ Quality
☐ Cost
Operational Structures, Objectives, and Performance Targets
1
Customer Sales and Service
4
Production Process
4a
☐ Production Efficiency
5
Facility Management and Maintenance
2
Product Design and Manufacturing Engineering
4b
☐ Quality Control
6
Material Management and Control
3
Management Information Systems
4c
☐ Product Cycle
7
Adminstrative Support
Financial and Market Performance
☐ Shareholder Value
☐ Profitability and ROI
☐ Market Share

■ TRAINING GRANT RECIPIENT:
Arcata Graphics
San Jose, California

Training Grant

Arcata Graphics received a $947,400 grant from the Employment Training Panel for training workers between April 1987 and February 1989. The training grant was used to provide newly hired workers with formal apprenticeship training on the production equipment that they were to operate. Experienced workers received more advanced training on the equipment, on the underlying principles of the operation of the equipment, and on troubleshooting. Also, experienced workers were cross-trained on operations that were related to their areas of specialty. All trainees received safety instruction. Newly hired workers received 20 hours of orientation and general safety instruction. Hourly workers were covered under a collective bargaining agreement.

Focus Of Case Study

This case study focuses on the linkages between training and company performance objectives in a comprehenisve training program. It gives special attention to defining and measuring performance objectives.

Overview of Company or Industry Receiving State Assistance

Arcata Graphics/San Jose is one of six divisions of the privately held Arcata Graphics Company. The San Jose division dates back to the turn of the century when it was incorporated as Phillips, Van Orden, and Smythe Company in San Francisco to print telephone directories. In 1968, Arcata was relocated from San Francisco to San Jose where an advanced printing facility was built on 17 acres. Arcata Graphics/San Jose is the only printing operation in northern California employing rotogravure technology.

The company consistently has made improvements in its production technologies. In 1980, after securing printing contracts for Parade and Family Week, a 13-unit Cerutti rotogravure press (largest in the U. S.) and two Helio-Klischograph cylinder engraving machines were installed. In 1983, photocomposition equipment providing direct data transmission between California and Pennsylvania were added to produce TV Guide. In 1985, a third Helio-Klischograph was installed, on-line shrink wrapping was added to the Cerutti, and two Hoe presses were upgraded.

Each week, Arcata/San Jose prints, binds, and mails 2.4 million copies of TV Guide and 5.1 million copies of the "National Features" section. In addition, the company prints 700,000 copies of the National Enquirer and 9.6 million copies of Parade, USA/Weekend, and West. In total, 12.6 million completed books are printed, bound, and mailed each week.

Competitive Problems Faced by the Company or Industry

Rotogravure printing is a specialized process resulting in a high quality printed product produced in exceptionally long runs. Primary competition for Arcata/San Jose comes from operations in the western states of Donnelley and Meredith printing companies. The high productivity of the Arcata/San Jose facility has enabled it to maintain its market share in the face of strong price competition.

As a consequence of Arcata's position as the sole gravure printing operation in northern California, the skills that are required to operate the equipment at Arcata/San Jose are not available readily in the local labor market. Although there is a larger supply of skilled gravure printers and pressmen on the east coast, the demand is so great there that it is not practical to attempt importing workers from there.

Strategic and Operational Objectives

Arcata/San Jose consistently has made improvements in its operations in order to achieve higher quality, lower waste, and increased throughput. In 1987, Arcata began to standardize its operations and attempt to alter the length of workshifts and to change the number of working days in a week. It was felt that this would enhance productivity by extending the length of production runs and by reducing the likelihood of waste by establishing stricter operational procedures.

The company also anticipated that it soon would be losing many of its experienced workers to retirement. This would result in many less experienced workers moving into jobs that would be several job classifications above their current positions. The company feared that this would have an adverse effect on its ability to compete effectively unless the workers replacing those who were retiring could work as productively.

Possible Company Performance Outcome Measures

Arcata Graphics/San Jose measures it performance by work unit (e.g., photo preparation, cylinder preparation, etc.), product (e.g., TV Guide, National Enquirer), and by shift. In addition, it regularly calculates the cost of quality, which is comprised of the costs associated with quality inspections and the cost of correcting mistakes. Also, the San Jose facility regularly assesses its overall performance against previous years and against expectations.

The following are examples of performance measures that relate to activities that presumedly would have been affected by training:

- Photo-preparation hours per page by product
- Hours of preparation per cylinder
- Printing runspeed by product
- Bindery runspeed
- Mail runspeed
- Overtime premium
- Excess paper consumption
- Cost of quality (by month)
- Changes in net income (annualized)

Need for Retraining, Description of Skills Training Objectives, and Expected Levels of Skills Attainment

The company anticipated that the retirement of experienced workers would result in a labor vacuum, pulling less experienced workers into highly skilled positions and opening several entry-level positions. However, Arcata/San Jose lacked a systematic apprenticeship program as well as a standardized training program for advancing workers to higher skilled jobs. At the same time, continued pressure on productivity forced the company to reform its operations in the expectation that performance gains could be achieved.

Skills training objectives and expected levels of skills attainment were established for every occupation in the plant. Expectations for newly hired workers were differentiated from those for experienced workers with respect to the depth of knowledge that was required. The skills training objectives and expected level of skills attainment were as follows.

Web assistant: Operating and troubleshooting for the stacker; loading and unloading the press; changing impression rollers; removing and installing doctor blades; assisting in webbing up the press; assisting the reel tender; knowing fundamentals of paper and ink properties.

Press operator: Press operators perform four basic functions (in increasing order of complexity): (1) operation of the reel; (2) operation of ink units; (3) operation of the folder; (4) set-up and operation of the presses. New hires were trained in all functions. Experienced workers received training in those functions that they could not perform adequately. In addition, all workers were expected to learn the theory and troubleshoot the operation of the electrostatic assist, maintain web tension, maintain registration of the product, troubleshoot color problems, and troubleshoot folder problems. The objective was to cross-train all press operators so that each could perform all functions.

Film technician (pre-press): Make color corrections; strip film; prepare film to be ready for engraving; operate the satellite data transmission system; perform basic engraving activities (cross-training).

Finisher (pre-press): Basic cylinder correction techniques; basic engraving (cross-training).

Engraver (pre-press): Perform engraving modifications on data received by satellite; change and reset engraving equipment; detect errors before the proof press point; perform basic activities of the film technician (cross-training).

Proof-press operator (pre-press): Make correlations between the proof press and the regular presses; perform basic press operation (cross-training).

Platers (pre-press): Cross training for copper and chrome platers; polishmaking.

Maintenance technicians: welding, waste retrieval system maintenance; maintenance of pneumatic systems; machinery repair (seven types of machines). (The purpose of this training was to cross-train workers in the maintenance of all production machinery.)

Bindery: Set-up, operation, and basic maintenance of six bindery department machines; coordination of bindery department machines.

Mailroom: Operation of pallet-based system; mail regulations; preparatory training for a new ink-jet mailing system; document control; set-up, operation and maintenance of stacking, shrink-wrap and labeling machine.

All workers received safety training conducted by the Safety Manager in Charge of Training. They were expected to learn key facts regarding right-to-know legislation and the use of personal protection equipment.

Description of Retraining Program

The retraining program was conducted by the safety manager in charge of training, by designated Arcata staff, and by representatives of vendors that provide equipment and raw materials to Arcata. Structured on-site training was provided by Arcata supervisory staff. It was interspersed with classroom training.

Training for all occupations occurred on all shifts during normal working hours at the Arcata/San Jose plant. Training was held for a minimum of two hours per day, three to five days per week.

The duration of training varied by job classification and by term of employment (e.g., newly hired workers received at least an additional 20 hours of orientation and safety

Job Classification	Sessions	Classroom	SOST
Web assistants	8	25 hrs	235 hrs
Press operators	5	55 hrs	285 hrs
Pre-press operators	6		
Film technicians		40 hrs	180 hrs
Finishers		40 hrs	160 hrs
Engravers		55 hrs	285 hrs
Platers		55 hrs	285 hrs
Proof-press operators		40 hrs	270 hrs
Maintenance technicians	3	40 hrs	270 hrs
Bindery	5	40 hrs	240 hrs
Mailroom	3	35 hrs	165 hrs

training). Safety training was a component that was common to all curricula. It was conducted by the Safety Manager in Charge of Training.

Need for State Assistance

Arcata Graphics/San Jose had not previously operated a training program for newly hired workers much less a program for journeymen to learn the set-up, operation, and maintenance of production equipment. The assistance received from the Employment Training Panel enabled Arcata to establish a formal training program.

Photo Preparation	(Hrs./Page)
West magazine	20% reduction
TV Guide	5% reduction
Hours per cylinder (set-up)	5% reduction
Runspeed	
West magazine	163% improvement
Parade magazine	31% improvement
USA/Sunday	7% improvement
National Enquirer	10% improvement
TV Guide - 1	12% improvement
TV Guide - 2	8% improvement
Copies bound per hour	2% improvement
Excess paper consumption	225% improvement
Mail copies per hour	Negligible
Overtime premium	22% reduction

Performance Outcomes

Arcata Graphics/San Jose reported the following performance outcomes in terms of changes in 13 week averages between the periods ending in the third week of July for 1988 and 1989:

In addition, Arcata Graphics/San Jose reported an increase in gross profit between 1987 and 1988 of 86 percent and an increase between 1988 and 1989 of 34 percent. The major factors contributing to the increases were an improvement in productivity and control of paper waste in the production process. Also, total man-hours were reduced by 19,200 hours between 1987 and 1988. Total man-hours in 1989 were 36,500 hours below the 1988 level.

Arcata Graphics' contracts permit a specified amount of paper waste. If Arcata overconsumes paper, the company must pay for the excess paper. If Arcata underconsumes, the company sometimes may share in the savings with the customer. In 1988, overconsumption was down by $251,000 from 1987. In 1989, Arcata Graphics actually underconsumed. This resulted in a net improvement of $547,000 from 1988.

Arcata Graphics/San Jose also provided an example of its cost of quality calculation. However, time series data were not available.

Training Outcomes

Arcata Graphics/San Jose established specific criteria to check progress and required that both supervisor and trainee jointly sign a checklist specifying that the trainee had met the performance criteria. Figure 1 provides an example of a progress check and performance checklist is attached.

Wages and Earnings of Workers

Workers are paid according to job classifications. Newly hired workers are paid by time of service until they have worked 270 shifts, and they are promoted to journeyman status.

Observations

This case study is an example of how state training grants can provide structure for a company training program. The training grant from the Employment Training Panel imposed discipline on the training process. This enabled the training manager at Arcata to enforce adherence to the training schedule and curricula.

Figure 1
Performance Checklist

STEP	GO	NO GO
Read and follow job instructions		
Check and prepare imprint plates		
Set up and operate imprinter		
Adjust ink viscosity		
Control lineup and quality during production		
Change and adjust doctor blades		

Employee's Signature

Instructor's Signature

TRAINING GRANT RECIPIENT:

AT&T Network Systems, Inc., Microelectronics Division Kansas City Works, Lee's Summit, Missouri

Training Grant

AT&T Network Systems, Inc. received a $474,362 grant from the Missouri Customized Training Program for retraining employees at the Kansas City Works between July 1, 1987, and June 30, 1988. Approximately one-third of this grant involved a training program for the implementation of a new Business Resources Planning System. Most of the remaining two-thirds of the grant was for retraining production workers in three product areas: Mercury Switches, Hybrid Integrated Circuits, and Connector Lines. The remaining training addressed factory automation, just-in-time delivery and electrostatic discharge.

The state training grant paid for the salaries of project staff from Longview Community College and AT&T who were involved in developing original training manuals and instructional material and providing direct training services. The grant also paid for materials and supplies and related administrative expenses. AT&T provided a $289,291 matching contribution to the project for additional staff salaries, supplies and materials, and contracted services.

Focus of Case Study

The case study focused on strategies and performance objectives in two areas: (1) the use of the Customer Service System component of the Business Resource Planning System to improve customer delivery performance and (2) the use of the Facility Management System component of the planning system to improve performance in facility maintenance.

Overview of Company or Industry

The American Telephone and Telegraph Company (AT&T) is a New York-based corporation that provides telecommunications and information products and services worldwide. The company's products and services include: voice, data, and image telecommunications services; telecommunication products ranging from voice instruments to complex switching and transmission systems; computers and data networking products and systems; and components of high-technology products and systems. These products and services are designed to serve three major customers: (1)

residential, government, and business users of telecommunications and information services; (2) the providers of these services including telephone companies; and (3) the manufacturers of telecommunications, data processing, and electronic equipment.

AT&T has annual sales of about $36 billion and employs approximately 304,500 people. About 52 percent of all employees are represented by unions. The Communications Workers of America (CWA) represents about 80 percent of all union employees. The International Brotherhood of Electrical Workers (IBEW) represents another 19 percent.

AT&T Network Systems, Inc. is a division that includes business units that primarily manufacture, market, engineer, and install switching systems, transmission systems, media products, cellular systems, and operations systems for AT&T, local exchange and other carriers, private businesses, and government agencies. AT&T Network Systems includes AT&T Microelectronics, a business unit that produces two broad categories of components: (1) integrated circuits and (2) other electronic components such as discrete components, power systems, and printed wiring boards that are included in the products and systems of AT&T as well as those of other companies.

The Kansas City Works of AT&T Microelectronics produces hybrid integrated circuits; interconnection devices such as pins and connectors including multifiber array (fiber optic) connectors; and a variety of electronic components including diodes, transistors, varistors, thermistors, surge limiters, dielectric resonators, sealed-contact switches, mercury switches, and relays. The facility opened in 1961 and currently employs approximately 1,400 people.

Competitive Problems Faced by the Company or Industry

The deregulation of the telecommunications industry, the 1984 divestiture of AT&T, and rapidly changing technology have placed strong competitive pressures on manufacturing facilities within AT&T Microelectronics. Since the early 1980s, AT&T business units have attempted to transform themselves from regulated monopolies to competitive businesses. This has necessitated a complete transformation in corporate culture as well as the rapid introduction of new production methods and technologies.

AT&T manufacturing facilities have been under strong pressure to lower costs, improve quality, and shorten manufacturing lead times for both AT&T business units (the traditional customer base) and the newly independent telephone companies. In addition, these facilities have been under pressure to meet the cost, quality, and delivery standards of foreign and domestic competitors. AT&T Microelectronics has targeted these external markets as the major source of future sales growth.

Since the 1984 divestiture, AT&T has phased out older manufacturing facilities, reduced manufacturing capacity, and used advanced technologies and production methods to improve quality and productivity within the remaining manufacturing facilities. In addition, AT&T increasingly has allowed its business units to purchase electronic components from outside suppliers if such purchases can make the units more competitive within their own markets.

The Kansas City Works has grown smaller over the last few years as old product lines have been phased out and AT&T continues to consolidate and reduce overall manufacturing capacity. In order to remain in operation, the Kansas City Works must constantly improve its overall operating efficiency and quality to remain competitive for new AT&T product lines and to retain the business of traditional AT&T customers.

Strategic and Operational Objectives

In the mid-1980s, the Kansas City Works, in cooperation with other AT&T business units, began to develop and implement a Business Resources Planning System that would support a manufacturing resource planning process and the transition to total quality control, just-in-time delivery, and computer-integrated manufacturing. The major purpose of the planning system was to support the company in meeting stringent quality control standards and shorter customer delivery schedules and at the same time reduce manufacturing costs by reducing inventories. The planning system was also important in implementing a corporate-wide strategy of developing closer linkages to customers through greater manufacturing flexibility and improved delivery performance.

The business resources planning system integrates eight major computer systems in the manufacturing resource planning process. The Extended Component Sales and Requirements System supports business and sales planning by providing two- and five-year sales forecasts that reflect various product and pricing strategies. The Customer Service System supports production planning by developing a proposed master production schedule based upon sales forecasts, customer orders, and finished goods inventory. The Program Acceptance Service System supports master production scheduling by assessing whether the proposed schedule from the Customer Service System can be done, given the work in process, the availability of components, and overall capacity planning. The Program Acceptance Service System then generates subassembly and component requirements from the finalized master production schedule. The Materials Management System supports material planning by providing an analysis of the availability of materials to the Program Acceptance Service System. The Materials Management System then uses the component requirements from the Program Acceptance Service System to review supplier orders. The Shop Control System provides detailed work-in-process information to the Program Acceptance Service System on whether the master schedule can be met and then executes the final master production schedule by providing shop floor control of all work-in-process through the production areas. The Quality System supports quality control for both in-process and out-going products through the use of on-line control charts, interactive statistical analysis, and test monitoring and reporting. The Facilities Management System supports the performance of the plant and production equipment by maintaining information on equipment parts and performance for preventive maintenance and more efficient repairs. The Product Movement System provides performance measures of the delivery of subassembly feeder parts and end products based on the master schedule.

The customer service unit is critical in managing tighter delivery schedules and meeting the on-time customer delivery performance of the Kansas City Works. The Customer

Service System provides support to the unit in a number of ways: (1) estimating customer demand and delivery requirements from customer orders and projected demand; (2) negotiating a master production schedule with the sourced production unit; and (3) performing warehouse functions of receiving, packing, and shipping. The Customer Service System was expected to shorten the updating of customer demand forecasts to provide more accurate master production scheduling. It also was expected to promote improved performance in meeting quoted delivery dates to customers.

The Facility Management System is critical in implementing a Total Productive Maintenance process at the Kansas City Works. The goal is to maintain the facility in original operating conditions with zero breakdowns under a continuous-flow, just-in-time delivery system. The Facility Management System supports the Total Productive Maintenance process by scheduling maintenance, monitoring work orders, and organizing information on maintenance history, instructions, documentation, and spare parts inventories. The Facility Maintenance system was expected to improve the performance of the facility management unit in reducing downtime and lowering overall maintenance costs.

Possible Company Performance Outcome Measures

The company targeted key performance objectives for the full implementation of Customer Service System and the retraining program. The company described three major performance indicators:

- Percentage of customer orders delivered within the delivery lead times advertised by the company.
- Percentage of customer orders delivered by the request date of the customer.
- Percentage of customer orders delivered by the delivery date acknowledged or promised by the company.

The company stated five major indicators for the performance objectives of the facility maintenance operations:

- Average downtime of production facility.
- Average number of unscheduled maintenance tasks.
- Average time to respond to and conduct emergency repairs and return the facility to full operation.
- Average unscheduled maintenance time in production facility.
- Total material and labor costs of scheduled and unscheduled maintenance.

Need for Retraining and Skills Training Objectives

The introduction of the Business Resources Planning System was associated with a substantial reduction of the workforce of the Kansas City Works. In the customer service unit, automation eliminated many clerical support positions required by previous manual systems. Few of the remaining employees had previous experience with material resource planning systems and required retraining to do their jobs within a highly computerized environment. The skills training objectives were to make all employees within the customer service unit proficient in using the Customer Service System.

The introduction of the new facility management system involved a major restructuring of the facility maintenance unit. Over 30 skilled trades classifications were reduced to 14, and a new productive maintenance program was introduced. People in the skilled trades and engineers in the maintenance unit as well as machine operators and production supervisors required retraining in order to implement the new maintenance program. Most maintenance workers, especially in the skilled trades, had no prior experience with computer systems and required retraining. The training objectives were to make these workers proficient in using the Facility Management System to plan and schedule maintenance, to process work orders, and to monitoring performance.

Training Program

The training program was conducted jointly by Longview Community College and AT&T. Staff from Longview worked with AT&T resource people in developing original training manuals and instructional materials for different components of the Business Resources Planning System. The training grant paid for the development of new instructional materials for the Customer Service System. Longview staff used these materials in a ten-week, four-hour per week training program for 51 AT&T employees on new features of the Customer Service System including classroom and laboratory training with formal lessons on the system.

The college also developed new training manuals and related instructional materials for new features of the Facility Management System. Longview staff used these materials to train more than 250 employees on the system. Trainees included production personnel, skilled tradesmen, engineers, and production and maintenance managers.

Need for State Assistance

Since the early 1980s, AT&T has implemented a very costly restructuring of its manufacturing facilities including the reduction of overall manufacturing capacity and the introduction of new production systems in remaining facilities. State training funds were important in encouraging AT&T headquarters to continue modernizing the Kansas City Works and to keep the facility open in the face of major shifts in AT&T product lines and customers.

Given the major resources committed to the modernization of the facility, the state training funds were critical in establishing a comprehensive and timely training program with formal classroom training provided to almost all AT&T employees in the customer service and maintenance units. Company management indicated that AT&T probably would have conducted some type of training on both the Customer Service System and the Facility Management System even without state assistance. However, management indicated that it would not have had sufficient training resources to prepare instructional manuals and lesson plans and train AT&T instructors. In addition, the company probably would not have been able to train the number of people quickly enough to achieve the desired results.

Performance Outcomes

One immediate impact of the full implementation of the Customer Service System was that it enabled customer demand forecasts to be updated within two days as opposed to two weeks. The number of staff required to produce the reports fell by about 50 percent. This provided the basis for more accurate and realistic scheduling of production and delivery. After full implementation and training, the customer service unit reported that most indicators of delivery performance improved by at least 30 percent.

The implementation of the Facility Management System also was associated with significant improvements in the performance of the facility maintenance operation. In the stamping area, the full implementation of the productive maintenance process and the use of the system with fully trained personnel resulted in a 30 percent reduction in total maintenance costs. The number of unscheduled maintenance requests was reduced by 50 percent.

Training Outcomes

The training program for the Customer Service System included formal pre-tests and post-tests on most instructional components. The pre-testing was conducted in order to better tailor instructional materials and to convince long-term employees that they required additional training. Training staff reported that pre-tests recorded a wide range of prior knowledge and skills with trainees scoring between 6 and 70 percent. Because training staff worked with trainees until they successfully mastered the required competencies, post-test scores averaged about 96 percent.

The Facility Management training program did not include formal pre-tests, but it did include informal post-tests. All trainees were asked to demonstrate functional skills in performing the major work tasks on the system. Formal post-tests on functional skills could have been defined easily and used in the training program.

Observations

This case study provides a good illustration of how state training funds can be used to enhance a training program at a major manufacturing facility. The state training funds were instrumental in insuring the success of the Customer Service System and the Facility Management System components of the Business Resources Planning System. In addition, the state training funds reinforced to AT&T management the strategic importance of training in implementing a major restructuring of the corporate culture and the implementation of a material resources planning system.

TRAINING GRANT RECIPIENT:
Care Enterprises, Inc.
Tustin, California

Training Grant

Care Enterprises, Inc. (CARE) received a $243,000 training grant from the Employment Training Panel in 1987 to retrain 135 employees. These employees were retrained to operate a new decentralized, automated accounting and medical records system that was being implemented in all nursing facilities operated by the corporation. The training grant paid for the following: (1) part of the direct instructional costs of 154 hours of training for 13 administrators and office managers on the accounts receivable and payroll modules of the system; (2) 101 hours of training for 18 administrators and office managers on the accounts receivable module only; and (3) 128 hours of training for the medical records systems on 104 assistant directors of patient services, medical records clerks, and patient service coordinators.

Overview of Company or Industry

CARE is a nationwide provider of comprehensive health services for the elderly. CARE currently operates 75 skilled and intermediate nursing facilities and two residential facilities in California, Utah, Ohio, West Virginia, and New Mexico. The nursing facilities provide skilled and intermediate nursing and rehabilitation services to patients who do not require acute care hospitalization. CARE also operates six pharmacies and ten home health agencies. The pharmacies provide products and services to CARE's nursing facilities as well as to other independently operated nursing facilities, and the home health agencies provide skilled nursing care as well as rehabilitation and homemaker services to patients outside the facilities. CARE employed approximately 8,500 people in 1988. It currently operates 55 nursing facilities in California.

Each of CARE's skilled and intermediate nursing facilities is operated by a licensed administrator and a director of nursing services, who are assisted on a contract basis by a physician who acts as a medical director. The services provided at CARE's skilled nursing facilities (and intermediate facilities to a lesser degree) include 24-hour nursing by registered nurses, room, board, housekeeping and laundry services, dietary planning, the provision of medical supplies and prescription drugs, the provision of rehabilitation services, and contract laboratory and X-ray services.

CARE maintains executive and regional administrative centers that provide supervisory, administrative, and consulting services to its nursing facilities. Each regional office is staffed by a regional administrator and support personnel specializing in nursing care, dietary programs, hospital accounting, and maintenance. CARE's executive offices provide centralized management and support services including operations support, marketing, accounting and financial services, cash management, data processing, legal support, risk management, quality control, centralized purchasing, education, training, and consulting support in rehabilitation services.

Competitive Problems Faced by the Company or Industry

The long-term health care industry for the elderly experienced strong growth in the late 1970s and early 1980s. During this period, CARE undertook a rapid expansion through acquisition and new construction that increased the company's bed capacity from 1,300 in 1978 to over 13,000 at the end of 1985.

During the 1980s, a number of factors combined to increase competitive pressures and lower profit margins in the industry. First, the certificate of need process was discontinued in many states, especially in Utah, Arizona, New Mexico, and California, where CARE has most of its nursing facilities. Certificate of need requirements control the construction of new nursing facilities and the expansion of existing nursing facilities within designated areas by establishing a review and approval process before any new construction can begin. As a result of the elimination of this process, competition among nursing care facilities has increased because of the increase in the number of newly constructed facilities. In addition, acute care hospitals have entered the long-term nursing care market. Occupancy rates in new buildings have fallen and the population has dropped in existing facilities due to the increased level of competition in these states.

Second, the introduction of the diagnostic related group (DRG) system in the acute care industry has had major effects on CARE's nursing facilities as well as other long-term nursing facilities. The DRG system gives acute care hospitals an incentive to discharge patients more rapidly, a policy that has increased the number of patients entering nursing homes. This has required increased staffing levels at CARE facilities above state regulatory requirements. Medical reimbursement increases have not kept pace with increased costs related to such higher activity levels, particularly in flat rate states such as California, where CARE operates the majority of its nursing facilities. The effects of these two factors have been worsened by rising public expectations and regulatory pressures on long-term care facilities and a serious shortage of registered nurses and other skilled health care workers.

Third, federal and state Medicaid reimbursement policies have put strong financial pressures on the long-term care industry. Payments received by CARE and its competitors are currently sufficient to cover a substantial portion, but not all, of the operating and fixed costs of providing services to Medicaid patients. This has posed a major problem for CARE in that approximately 51 percent of the company's revenues come from Medicaid reimbursements.

The combination of these factors and the highly leveraged capital structure of the industry due to rapid expansion in the late 1970s and early 1980s have resulted in decreasing profit margins in the industry and serious financial problems for some companies. CARE, along with may of its competitors, has been forced into a strategy of cost containment, downsizing, and corporate restructuring in order to reduce costs and return to profitability. In March 1988, CARE filed a voluntary petition with the United States Bankruptcy Court for relief under Chapter 11.

Strategic and Operational Objectives

In the mid-1980s, CARE set out to reduce operating costs and improve the cash management of nursing facilities by decentralizing an automated accounting system for accounts payable and payroll so that facility administrators could have better-quality information more quickly at a lower overall cost to the corporation. One major objective was to reduce corporate overhead, especially corporate staff costs during a time of company expansion. In addition, CARE also attempted to reduce operating costs by establishing an in-house automated medical record and physician ordering system. Up to the mid-1980's, CARE facilities had manual systems with each facility contracting out to an outside vendor for data entry and report generation.

Possible Performance Measures

CARE had specific operational objectives in automating and decentralizing its accounting system and introducing an internal medical records system. There were three major objectives.

- **Corporate Staff Costs.** To reduce corporate staff overhead costs for report generation for nursing facilities.

- **Report Turnaround.** To reduce the average time of the generation and receipt for standard accounts receivable and payroll reports from time of data close-out.

- **Contract Elimination.** To save costs by eliminating contracts with external vendors for data entry and report generation for medical records and physicians' orders.

Need for Retraining and Training Objectives

Although most CARE employees had experience in preparing the information for accounts payable, payroll, and medical record reports, only a few had any experience with computers. Most did not have any data entry or keyboarding experience and were not familiar with the mechanics of an automated management information system. As a result, all office and medical records personnel required retraining to take responsibility for the system in their own facilities.

Training Program

The training program included three major groups, which received a combination of classroom and laboratory instruction at centralized regional training centers and structured on-site training with a follow-up team at their facility using the newly installed system. The first group included 13 administrators, office managers, and assistant office managers who received 154 hours of training on the accounts payable module and the payroll module of the new management information system. Training included 11 hours of classroom instruction, 31 hours of laboratory instruction, and 112 hours of structured, on-site training. This training was conducted over 12 weeks. The second group included 18 administrators, office managers, and assistant office managers who received training only on the accounts payable module. This group received 5 hours of classroom training, 16 hours of laboratory training, and 80 hours of structured on-site training. This training was conducted over six weeks. The third group consisted of 51 medical records clerks, 25 assistant directors of patient services, and 28 patient services coordinators from 50 nursing facilities. They received training in the new medical records and physician order systems. This training consisted of 32 hours of classroom training and 96 hours of structured on-site training over 11 weeks.

Need for State Assistance

CARE did not have the financial resources to plan and implement a comprehensive retraining program for employees. The state assistance provided the resources to devote more corporate staff time to classroom and laboratory training.

Performance Objectives

CARE achieved its largest impacts from the new system in cost reductions at corporate headquarters. After full implementation of the new decentralized system, CARE was able to reduce its corporate management-information-system staff from 30 to five with no additional staff required at the facilities. In addition, each facility was able to eliminate its external contracts for data services for medical records. This resulted in an approximate saving of $500 per month per facility. Report turnaround in the centralized system ranged from four days to two weeks.

Training Objectives

CARE did not do formal post-testing for its training programs on the accounting, payroll, or medical records modules. However, CARE felt that there would be no problem in defining functional skills on the new system and confirming that all trainees could perform these skills. The trainees who were interviewed felt that their training would prepare them to work on automated accounting and medical records systems in other companies if they had to find employment outside the company.

Observations

This training project illustrates the importance of the integration of classroom and structured on-site training for training transfer in projects focusing on training in management information systems. The trainees indicated the importance of being able to apply their training to actual job tasks on a week-to-week basis.

■ TRAINING GRANT RECIPIENT:

Dresser-Rand Company Engine Process Compressor Division
Painted Post, NY

Training Grant

In 1987, the Painted Post facility of Dresser-Rand Corporation received a $148,500 grant from the New York Economic Skills Training Program in order to implement a skills training program for approximately 1,000 employees between May, 1988 and August, 1989. The company organized a joint labor-management training committee to develop and implement the training program. The project included both basic skills and advanced technical skill training. The basic skills program for manufacturing employees consisted primarily of basic skills instruction and review in reading and math; blue print reading; and shop math, precision measurement and machine operations. The advanced technical training program consisted primarily of introductory and basic computer applications; basic N.C. programming; and instructor training for the development of courses in carbide tooling, computer system applications, and product recognition and application.

The state training grant was used to pay for instructor costs for both the basic skills and advanced skills training. Approximately $74,500 was for instructor salaries for basic skills instruction in cooperation with the Steuben Alleghany BOCES. The remaining $74,000 was for instructor salaries for the advanced skill training in cooperation with Corning Community College. Dresser-Rand provided about $314,000 in matching contributions for instructor costs for the basic skills program. The company provided about $267,000 in matching contribution in direct instructor costs for the advanced skill training. In addition, the company contributed about $584,000 in the form of employee release time for classroom training.

Focus of Case Study

This case study focused on the basic skills and advanced skills training provided to workers in the machining unit. It focused on the basic skills courses and the training in carbide tooling and machine operations which were completed as of May, 1989.

Overview of Company or Industry

Dresser-Rand Company is a joint venture of Ingersoll-Rand Company, Woodcliff Lake, New Jersey, and Dresser Industries, Dallas, Texas. The company has six major divisions:

Steam Turbines, Motors and Generators; Turbo Products; Engine Process Compressors; Compression Services; Product Support; and Dresser-Rand Power, Inc. Dresser-Rand has ten manufacturing and testing facilities and employs over 7,000 persons worldwide.

The Painted Post facility is the headquarters facility for the Engine Process Compressor Division of the new company. The Division manufactures compression equipment and gas engines for the refining and oil field industry; compact low-weight, air-cooled compressors for navel, marine, and aircraft applications; and navel and marine air compressors for the military. The Painted Post Plant employs approximately 1,550 workers. It is an engineering and manufacturing facility that provides custom-engineered and built equipment for specific power and compression applications up to 24,000 HP. Hourly workers in manufacturing are represented by the International Union of Electricians Local 313.

Competitive Problems Faced by the Company or Industry

In the early 1980s, Ingersoll-Rand and Dresser Industries faced sagging markets in the depressed oil and gas industries and a manufacturing overcapacity coming from United States' competitiors such as Coopers Industries as well as foreign competitors from Europe and Japan. They also were faced with rising quality demands under strong cost competition.

Between 1981 and 1986, Ingersoll-Rand went through a major restructuring in order to remain competitive. Beginning in 1981, Ingersoll-Rand specialized and consolidated its plants. Ingersoll-Rand consolidated gas and engineered products at its Painted Post facility. Other standardized product lines which were produced at the facility were transferred to plants outside the state.

During this period, the Painted Post facility was competing with other Ingersoll-Rand facilities and external competitors to retain their major product lines. In order to improve their competitive standing, upper management at Ingersoll-Rand's Painted Post facility initiated a $40 million modernization plan that involved a transition from cast to fabricated components; the implementation of manufacturing cells and computer-integrated manufacturing; the implementation of a program to improve labor-management relations including employee involvement teams; and the restructuring of the compensation system which included salary and hourly benefit reductions and the transition from an individual incentive system to a plant-wide gain-sharing plan.

Beginning in 1981, Ingersoll-Rand management at Painted Post attempted to improve the competitive position of its foundry through stronger employee involvement, changes in work rules, and reductions in wages and benefits. However, in 1985, the foundry was closed due mainly to strong cost competition and foreign outsourcing.

In 1987, Ingersoll-Rand and Dresser Industries established the Dresser-Rand joint venture. The Painted Post facility as an engineering and manufacturing facility within the Engine Process Compressor Division, was designated to engineer and build a wide range of customized products under Ingersoll-Rand, Worthington, and Clark product lines. This consolidation of major product lines at the Painted Post facility required an expansion of 300 employees. Under union agreement, this expansion was done through a recall process that gave priority to previously laid off workers from the plant and the closed foundry.

Strategic and Operational Objectives

As part of the overall consolidation and modernization plan at Dresser-Rand, upper management at the Painted Post facility established the strategic objectives of improving productivity, quality, and shop supply utilization. The major operational objectives of the Painted Post facility were defined in the gain-sharing plan. These objectives were:

- **Productivity** - improve productivity as measured through direct labor costs
- **Quality** - improve quality as measured through the costs of spoilage, scrap, and reclamation
- **Shop Supplies** - reduce the costs of shop supplies

Possible Company Performance Outcome Measures:

In establishing the gain-sharing plan, the company established specific performance outcome measures as well as specific performance targets based on the company performance in 1984. The gain-sharing plan included the following measures:

- **Labor costs** - total payroll costs including fringe benefits (excluding retirement) as a percentage of the sales value of production.
- **Wastage** - total value of materials contained inspoilage, scrap, and reclamation as a percentage of the sales value of production.
- **Supplies** - total value of operating supplies that were used as a percentage of the sales value of production.

These three performance measures and the performance targets based on 1984 relationships could provide a solid base for evaluating the long-term effects of this training program.

Need for Retraining and Training Objectives

The transition to cell manufacturing at the Painted Post facility substantially increased the skill requirements of production workers in the machining unit. Cell technology incorporates all of the manufacturing processes for a family of parts in one work area. Employees were moved from singular classifications to cell classifications that required operators to perform all operations for a family of parts. The manufacturing cells were organized as employee teams with strong employee involvement in problem-solving and decision-making. In addition, the joint venture resulted in the consolidation of different product lines in the facility. Production workers were required to understand unfamiliar product lines and component parts. This required workers to read and interpret blue prints rather than rely on previous work experience with traditional product designs and components. Finally, the transition to computer integrated manufacturing required more mainframe and PC networking, computer-aided design and engineering integration with numerically controlled machine tool programming, and general computer literacy among workers. These factors required that all manufacturing employees have strong basic skills and a common knowledge of blue prints, quality control, precision measurement, and machine operation so that they could be effectively cross-trained to operate all of the basic machining processes within a particular manufacturing cell.

Most Dresser-Rand employees at Painted Post did not have sufficient basic and technical training. Previous training was tied to specific machine operations with most workers familiar with one machining process with traditional Ingersoll-Rand product lines. In addition, most skilled machinists with broad training and experience were older workers who were likely to retire in the near future. Finally, the joint venture lead to the hiring of 300 new workers who did not have previous machine shop experience. Most of these workers were recalled employees with manufacturing support experience and foundry experience.

Training Program

Dresser-Rand in cooperation with the International Union of Electricians Local 313 established a joint labor-management committee, called the Joint Training Council, to plan and implement the skills training program for the manufacturing unit. Beginning in November, 1987, the committee formed four subcommittees in order to address four separate problems: (1) basic skills, (2) program goals, priorities and operating guidelines, (3) inconsistencies in the blueprints of Ingersoll and Dresser products, and (4) motivation for training.

The Joint Training Council designed and implemented a training program that would provide the foundation for future company training efforts to reach the performance objectives that were operationalized in the gain-sharing program. The committee targeted basic skills and more direct efforts to use retraining to reduce tooling costs, a major component of overall shop supply costs.

The basic skills program for manufacturing employees was developed in cooperation with the Steuben Allegheny BOCES. The program consisted primarily of basic skills instruction and review (reading and math) for about 140 workers; 20 hours of instruction in blue print reading for about 280 workers; and 80 hours of shop math, precision measurement and machine operations for about 100 recalled workers. This training was delivered by company employees and outside teachers hired and managed by the committee through the Steuben Allegheny BOCES.

The advanced technical training program was developed in cooperation with Corning Community College. The program consisted primarily of introductory and mainframe computer and PC software applications computer training for 500 workers; ; 20 hours of basic N.C. programming for 50 workers; and 30 hours of instruction in advanced APT programming for 10 workers. The program also involved "train the trainer" instruction to Dresser-Rand employees who were used to teach courses in carbide tooling, system user applications, and product recognition and application.

The committee designed the training program as a voluntary program in which workers were encouraged to participate. The Joint Training Council promoted the program and monitored and revised the program in order to maximize employee support and participation. If workers enrolled in a training course that was related to their job skill requirements, the company provided that training on company time. If the course was not necessary for job requirements, the company provided the training on a split-time basis with the worker attending class on their own time for 50 percent of the total training hours. Most of the training program was conducted on company time.

Need for State Assistance

Dresser-Rand Company was undergoing a major consolidation and modernization of the Painted Post facility which involved an unprecedented training investment. Although the company targed a substantial share of its resources to retraining, it required the financing and technical (program and instructional design) assistance of the state to implement a comprehensive training program including necessary basic skills instruction. The company reported that the state assistance expanded the scope of the training project and insured that the training would occur in the time frame necessary to implement the required organizational and technological changes at the facility.

Performance Outcomes

At the time of the case study, most manufacturing workers had completed the basic skills asessment. There were approximately 720 enrollments in training classes. Upper management reported that manufacturing cells were implemented in about 50 percent of the manufacturing unit. After the completion of the basic and advanced skill training, the company expected significant returns in all three performance areas targeted in the gain-sharing plan. The company already had noticed improvements in productivity as a result of manufacturing workers not having to stop and ask engineering support personnel about production issues based on blue prints and engineering instructions.

The only performance area where operational changes and training had been completed at the time of the case study was in carbide tooling. The carbide tooling course was organized and taught by company employees with training from Corning Community College. After completion of the training program, the company reported that carbide tool supplies were reduced by about $140,000. This cost reduction should result in the company achieving its performance target in the reduction of the costs of shop supplies.

Training Outcomes

All company employees were required to complete the CAT assessment in order to participate in the training program. Basic skills assessment information was provided to the company by the Steuben Alleghany BOCES on an aggregate basis. Individual test information was kept confidential. It was maintained by the Steuben Alleghany BOCES and was not provided to the company. Most basic and advanced training classes involved various types of pre- and post-tests.

By May, 1989, 447 employees had completed the CAT assessment. The Joint Training Council reported substantial improvements in basic and technical skills as a result of the training program. The average point increase for algebraic, geometric, and trigonmetric functions ranged between 12 and 19 percentage points. The average point increase for machinist's and welder's blueprint reading ranged between 27 and 35 percentage points. All employees who were interviewed reported that the training program met their needs. They also felt that the skills that they received would help them find employment with other companies if they lost their jobs.

Observations

This case illustrates the important role that joint training committees can play in planning and implementing a training program in unionized companies. The Joint Training Council was critical in establishing trust in the training program and making sure that the training program met the training needs of hourly workers at the Painted Post facility.

This case also illustrates the importance of basic skills testing and training in the transition to cell technology and computer-integrated manufacturing. This basic training in shop math and blueprint reading as well as other skill areas were important in adapting workers to major changes in the facility and allowing them to be full participants in production process.

■ TRAINING GRANT RECIPIENT:

Dunlop Tire and Rubber Company
Town of Tonawanda (Buffalo), New York

Training Grant

Dunlop Tire and Rubber Company received a grant for $327,993 from the Economic Development Skills Training Program. Total project costs were $2,179,296. Also contributing to the project were the Western New York Regional Economic Development Corporation ($41,368) and the Town of Tonawanda ($9,080). The company contributed $1,800,855 in release time.

The project was developed and implemented with oversight from a joint labor and management skills committee. Production personnel received training in tire building, calendaring, and operator tasks (such as welding, instrumentation and use of computers). Nonproduction employees (maintenance workers, electricians, toolmakers, welders) received training in basic electricity, electronics, troubleshooting, blueprint reading, and instrumentation. Also included in the training package were training in basic office automation, training in Japanese culture, and training in team building and communications. In addition, company trainers received instruction in how to train adult workers.

Focus of the Case Study

The project began in early 1989 and was continuing at the time of the case study. This case study addresses generally all aspects of the training project, but focuses on the training given to tire builders.

Overview of Company or Industry

The Dunlop Tire and Rubber Corporation facility in Buffalo, New York, produces motorcycle tires, truck tires, passenger tires, and tires for light trucks. The tires are bias and radial designs.

Dunlop in the United States is owned by an investment group consisting of Sumitomo Tire Co. and Sumitomo Electric of Japan as well as by Dunlop employees through a stock option plan. The Dunlop Tire plant at Buffalo was built 65 years ago and was the first plant opened in the United States by British Tire and Rubber company, the originator of Dunlop Tire Company. Dunlop was held by British Tire and Rubber, and its successor BTR until it was sold in 1984 to British Holdings because of financial difficulties in the parent's European division. British Holdings subsequently put both

European and American divisions up for sale. Within one year, the American division was purchased in a leveraged buyout to prevent a takeover by parties interested in liquidating the assets of the company. In 1987, Sumitomo purchased the American division of Dunlop. The investment group holding Dunlop subsequently was expanded to include Sumitomo Electric and the employee stock ownership plan.

Competitive Problems Faced by the Company or Industry

In May 1989, Dunlop became an original equipment manufacturer to U.S. automaking facilities. Prior to making this switch, Dunlop operated only in the replacement tire market. However, despite expanding its market, Dunlop lost money, primarily because of the declining demand for its bias ply tire line. It determined that in order to continue operations at the Buffalo plant, the facility had to improve its operating efficiency and to bring in a new product line. In particular, the management at the Buffalo facility felt the competition from its sibling Huntsville plant, which operated profitably because of its superior product mix and lower operating costs.

Strategic and Operational Objectives

The effort beginning in 1986 to redirect the activities at the Buffalo plant was supported by the Western New York Economic Development Corporation, a subsidiary of the Urban Development Corporation. It provided funding under the Industrial Effectiveness Program to the Center for Industrial Effectiveness at the State University of New York at Buffalo to undertake a full-scale assessment of the production techniques at Dunlop. The center also was to make recommendations to the company's joint labor and management committee on steps needed to make the company more productive. The study, completed in 1987, reported that the equipment at the Buffalo facility needed to be modernized and that the product mix had to be expanded to include radial automobile and light truck tires. The loss of market demand for the bias ply tire largely had caused the Buffalo facility to lose money.

As a consequence of the report, the company decided to install new calendaring (calendaring is the process by which steel belts are laminated to create radial ply) and tire building equipment in order to enter the radial automobile and light truck market. In addition, it decided to make improvements in the production efficiency of the plant. A joint labor and management committee was formed to develop a plan for implementing the strategy. This committee was assisted by the Center for Industrial Effectiveness.

Possible Company Performance Outcome Measures

The far-reaching characteristics of the proposed training program resulted from the company's desire to achieve several operational objectives. Measures of these outcomes included the following:

- **Improve Quality:** Reduce waste cost measures (daily, monthly, and year-to-date defect reports);

- **Reduce Start-up time:** Lower start-up time to meet tie expectations.
- **Improve Changeovers:** Reduce changeover time.

Need for Retraining and Training Objectives

The assessment performed by the Center for Industrial Effectiveness at the State University of New York at Buffalo established that Dunlop lacked a formal training program to teach workers the skills they required to operate the production machinery effectively and efficiently. In addition, the absence of the formal training program made it impossible to teach workers new concepts and operating procedures for improving quality and efficiency.

The following training objectives were established:

TIREBUILDING

- **Troubleshooting:** Be able to perform basic machine and material troubleshooting tasks.
- **Teamwork:** Be able to act and operate as a team member.
- **In Process:** Be able to complete all tirebuilding operations.
- **Communications:** Be able to communicate in a "world class" manner.
- **Business Awareness:** Demonstrate a basic awareness of the factors contributing to competitiveness.
- **Training Others:** Demonstrate basic training skills (for workers who later functioned as trainers).
- **Operator Changeover:** Demonstrate ability to perform operator (non-mechanical) aspects of changeover.

CALENDAR OPERATOR

- **Troubleshooting:** Be able to perform basic machine and material troubleshooting tasks.
- **In Process:** Be able to complete all calendaring operations.

MEDIUM TRUCK RADIAL TIRE BUILDING

- **Troubleshooting:** Be able to perform basic machine and material troubleshooting tasks.

- **In Process:** Be able to complete all tirebuilding operations.
- **Operator Changeover:** Demonstrate ability to perform operator (nonmechanical aspects of changeover).

Description of Retraining Program

Figure 1 provides a comprehensive overview of the training schedule for the tire building component (including the stage of training related to the development of in-house trainers). Similar schedules were used in the other components of the retraining project at Dunlop. The process used to develop, implement and evaluate the tirebuilding retraining component of the project included the following steps:

1. **Plant Communications:** Written and verbal communications were issued to educate the plant regarding the objectives, significance and schedule of the project. Periodic updates were to be issued as well.

2. **Measurements:** Quantitative and qualitative information was collected for the tirebuilding department in general and for the demonstration machines in particular. This will include the use of the survey technique (below).

3. **Survey:** A survey was administered by the Center for Industrial Effectiveness in order to determine attitudes and needs that can be considered in the training projects.

4. **Volunteer Team Leaders and Alternates:** Working with leadership from the United Rubber Workers Local 135, Dunlop sought team leaders and team alternates. These individuals were to receive specialized training and were to train other workers after the training system was developed.

5. **Identification of Training Demonstration Blocks:** Four properly operating machines were identified for first stage stationary, first stage shuttle, second stage stationary, and second stage shuttle. The selection was parallel to the selection of operators of these machines (i.e., four machines matched with four team leaders, with team defined as all operators assigned to that type of machine.

6. **Cleaning of Demonstration Machines**

7. **Installing of Signs and Paint Blocks**

8. **Communication Training:**The four team leaders, four alternates, and some supervisors participated in eight, two-hour communications training sessions. The subjects covered in these sessions included listening skills, complaints, positive discipline, motivation and attitude, improvement of performance, confronting skills, and conflict resolution.

9. **Set-up Task Analysis:** A task analysis that identifies and specifies the details of a job was performed for each demonstration block. This analysis was accomplished with the cooperation and assistance of team leaders and supervisors. Team leaders worked

with the personnel from the Center for Industrial Effectiveness in the documentation of steps in the set-up.

10. **In-process Task Analysis.**

11. **Troubleshooting Task Analysis.**

12. **Set-up/Process/Troubleshooting Guide Development:** The task analyses were used in the development of guides that broke down the job or troubleshooting process into tasks. Each task description included an explanation of why the task was important and how it related to downstream and upstream tasks. The guides also contained actual reference photographs. They were modular and were located at the workstations for on-the-job use. The troubleshooting guides identified fault conditions and cited potential causes for the fault. Also listed were corrective actions to overcome the conditions. The guide explained the causes of certain fault conditions and the reasons for corrective actions.

13. **Demonstration for Supervisors**

14. **Team Leaders Technical Training**

15. **Team Alternates Technical Training**

16. **Team Building Training:**Team building was aimed at giving personnel an understanding of the makeup of teams, how they operate, how they may be led, and how they may be controlled. A general outline of the topics covered in the training included concept of the team, team design principles, motivation, team leadership, delegation, and control. The team leaders, alternates and two supervisors were trained.

17. **Training the Trainers:** Team leaders, alternates and the two supervisors participated in training-the-trainer sessions. The training was to help them understand how people learn, the importance of the environment, and general training skills. The content of the training consisted of general learning theory, setting the right climate, and instruction on training techniques.

18. **Leaders and Alternates Cross-Training:** The leaders and alternates applied the skills that they learned by training each other so that each leader and alternate would go through the training for each of the four machines.

19. **Training of Operators from All Shifts.**

20. **Post-training Measurements.**

21. **Continuous Improvement.**

Need for State Assistance

Dunlop's Buffalo facility was competing against a possible relocation of operations to a vacant Firestone factory in Georgia. The assistance from the state was essential in giving the Buffalo facility a competitive advantage over a possible Georgia relocation. The Buffalo plant needed to overcome two advantages of the Georgia facility. First, the Georgia facility essentially would have been a green field operation; the workers operating the plant would come freshly to Dunlop and their work habits would not be colored by previous Dunlop experience. Second, the new facility essentially would be a turnkey operation. Start-up of the new tire building lines would not have to occur at the same time and place as existing bias ply manufacturing operations.

Performance Outcomes

The training project at Dunlop Tire and Rubber Company still is underway. The company regularly documents performance and should be able to document changes in performance at the completion of the project.

Training Outcomes

Dunlop officials reported that each worker was assessed, and it was determined that each was able to perform the tasks for which he or she received training. Data on these assessments were not aggregated, however. Documentation of training outcomes was not available at the time the case study was prepared.

TRAINING GRANT RECIPIENT:

General Motors
Buick/Oldsmobile/Cadillac Division
Wentzville Assembly Center Wentzville, Mo.

Training Grant

General Motors received a $785,980 training grant from the Missouri Customized Training Program to retrain 1,400 production workers and 110 skilled trades workers who were being transferred from the St. Louis Truck and Bus Plant. One major component of this grant was job aides development and production training for assembly line workers and preparation of the St. Louis management and supervisory workforce for new management and work practices. The second major component was technical training for skilled trades workers in the maintenance operation. The state grant covered approximately $500,000 of on-the-job training expenses and $285,980 of classroom training expenses including instructor salaries and instructional materials and supplies. General Motors provided direct matching funds of $500,000 in on-the-job training support and $720,000 for instructor salaries and instructional materials and supplies.

Focus of Case Study

This case study focused on the job aides development and production training of assembly line workers and its importance to the productivity and quality control objectives of the Wentzville facility. The case study also focused on the skilled trades training and its importance to the performance of the maintenance operations.

Overview of Company or Industry

The Wentzville Assembly Center is part of the Buick-Oldsmobile-Cadillac (BOC) Division of General Motors. The plant opened in 1983 as one of the most automated assembly centers in the BOC division. In 1985, the plant expanded to a second shift. In 1987, the plant expanded again with the addition of workers transferring from the St. Louis Bus and Truck Plant. The plant currently employs approximately 6,500 workers. The major product lines are mid-sized and luxury automobiles including the Buick Electra and Park Avenue, the Oldsmobile 88 and 83, and the Pontiac Bonneville. Production and skilled trades workers are presented by the United Auto Workers, Local 2250.

Competitive Problems Faced by the Company or Industry

Growing productivity and increased foreign competition has resulted in a manufacturing capacity in the auto industry that exceeds future sales projections. In response, Amercian auto companies have begun to reduce and consolidate their manufacturing capacity. They have begun to phase out or modernize older assembly plants and open up new highly automated facilities with advanced technologies and new production methods. This consolidation and reduction in manufacturing capacity is likely to continue well into the 1990s.

The future survival of new automotive assembly centers such as Wentzville is dependent on their ability to remain competitive among other GM assembly centers as well as other major domestic and foreign assembly plants. The Wentzville Center must remain profitable and competitive in productivity, cost, and quality. Failure to remain competitive on these criteria could result in the transfer or consolidation of current model production in other GM plants or the selection of competing facilities for new model production.

Strategic and Operational Objectives

The reduction and consolidation of manufacturing capacity within GM involved both the opening of the Wentzville Assembly Center and the closing of the St. Louis Truck and Bus Plant. The closing of the St. Louis plant was accompanied by the expansion of production at the Wentzville plant with approximately 1,400 production workers and 100 skilled trades transferring to new jobs at Wentzville. These employees were transferred from a non-automated assembly plant which produced pick-up trucks at 30 JPH to a highly automated plant that builds luxury cars at a 68 JPH. They were also being transferred from a plant with traditional job designs and work procedures to a facility that had adopted employee involvement and team concepts into the production process.

The Wentzville facility faced the challenge of how to expand current production and integrate the new workers from the St. Louis plant without major losses in productivity and quality. Management was concerned about meeting the acceleration schedule of the new production lines given the training requirements of the new workers. They also were concerned that this acceleration schedule be achieved without major drops in quality audit scores at the facility. The major objectives of the plant expansion was to at least meet the planned acceleration schedule and meet or exceed the productivity and quality audit standards within Wentzville and the BOC division.

When the facility was first opened, the Wentzville Assembly Center was the first GM fully-automated Body Shop to consistently achieve full production rates. Management was concerned that the productivity goals of the expanded production could be met only if the skilled trades transferring from the St. Louis Plant were trained quickly in order to prevent and minimize unscheduled downtime and maintain full production rates.

Possible Company Performance Outcome Measures

The performance objectives of GM management at the Wentzville facility could be measured through the productivity and quality audit scores of the company and standard measures used by industry analysts:

- Productivity as measured by line speed or by daily output per worker.
- Quality audit scores or the incidence of quality defects by department relative to GM or industry competitive standards.

The performance objectives of the maintenance unit could be addressed through two standard indicators:

- Average downtime of production facility.
- Average response/repair time in conducting unscheduled repairs and returning the facility to full operation.

Need for Retraining and Training Objectives

When the Wentzville facility opened in 1983, GM was able to recruit experienced, journeyman-level skilled trades workers from other GM facilities and other manufacturing companies. They also recruited some skill trades workers from construction backgrounds. However, when the company started to train these workers, they discovered that most workers needed basic skills training and additional vocational and technical training in order to maintain the new machinery and equipment, especially robots and programmable controllers. As a result, the company, in cooperation with the Missouri Customized Training Program and the Lewis and Clark Vocational Technical School, initiated a Hi-Tech Program to upgrade the skilled trades in the facility.

Based on this experience, the company anticipated the same problems would occur in training the skilled trades workers transferring from the St. Louis Bus and Truck Plant. This plant had very few robots and programmable controllers. The company also anticipated basic skills problems. As a result, the company developed an accelerated retraining program for these incoming skill trades workers that would allow them to develop all of the necessary technical skills within one to two years of training and work experience.

The production workers coming from the St.Louis plant had no experience in the new production methods used at the Wentzville facility. They also had never worked in a highly automated plant with line speeds of 68 JPH. The company felt that these transferring assembly workers would require formal training in quality control, teamwork, and standardized work procedures. In addition, the company felt that these workers could benefit from the development of visual job aides that document standardized work procedures.

Description of Training Program

The Hi-Tech Training Program for skilled trades workers was designed and conducted in cooperation with the Lewis and Clark Area Vocational and Technical School. Skilled trades training included both classroom and laboratory training at three levels: (1) Technical Level I - Basic Courses, (2) Technical Level II -Technical Courses, and (3) Technical Level III - Equipment Courses (See Figure 1). Technical Level I courses represent prerequisites for Level II courses. Technical Levels I and II provide the necessary foundation for Level III courses.

Basic Courses include approximately 200 hours of instruction in math, blueprint reading, and fundamentals of technology. Technical Courses include approximately 1200 hours of a wide variety of courses that are available to skilled trades workers depending on their job requirements. Equipment Courses include approximately 500 hours of instruction on specific machines and equipment in the Wentzville facility. These courses expand on standard vendor training materials.

The Hi-Tech Training Program is administered jointly by Lewis and Clark and the company with instructors provided by both the school and the company. Lewis and Clark provides instructors for the basic skills components and some of the technical skills areas. The company utilizes their own instructors including skilled trades workers to teach technical and equipment-level training.

The Hi-Tech Program was adapted specially for the 110 transferring skilled trades workers. It was adapted into an accelerated program that included an average of 800 hours of classroom and laboratory training per trainee followed by 80 hours of on-the-job training. This essentially compressed the necessary basic, vocational and equipment coursework into a 12-month training program by enrolling trainees in courses for 4 hours per day as opposed to the standard 2 hours per day. Trainees were given different courses depending on the skill levels and their specific trade. This compressed program required 10 additional instructors because of a 40 percent increase in enrollments in the standard Hi Tech courses.

The training program for the new assembly line workers involved a one-week classroom training program that provided an orientation to the facility and training in team-building and quality control. This classroom training was followed by 80 hours of on-the-job training in which an instructor was doubled up with a trainee and the trainee was shown standardized work procedures at lower than average line speeds. In addition, the training program also included the development and use of visual job aides for insuring standardized work procedures and quality control especially for assembly procedures regulated under Motor Vehicle Safety Standards (MVSS).

Need for State Assistance

General Motors invested approximately $12 million in the 1987 expansion of the Wentzville facility. The corporate budget for the facility expansion did not include sufficient training resources to provide a comprehensive retraining for skilled trades and assembly workers coming from the St. Louis plant. The state funds were instrumental in allowing for an intensive retraining program for the skilled trades that in effect reduced the required training time by over 50 percent. The state funds also allowed for a more comprehensive training of assembly workers so that the transition could be completed without major losses in productivity or quality. In general, the state funds allowed the more workers to be included in a more comprehensive and concentrated training program than could have been provided under company resources alone.

Company Performance Outcomes

The company reported that it was successful in maintaining full production rates after the integration of the retrained workers from the St. Louis Plant. In addition, the facility was able to improve its quality and productivity rankings. No additional performance information was available at the time of the case study.

Training Outcomes

The Hi-Tech training program for skilled trades workers was developed through competency-based training design. This approach is accepted as a standard within General Motors and is called Protrainer. Skilled workers were given post-tests for almost all of the basic skills and technical training courses. Some pre-testing was done to determine basic skills. In addition, some of these courses were coordinated with certificate programs offerred by Lewis and Clark so that successful completers could receive vocational certificates.

The production training involved post-testing in the form of a certification by supervisors that a trained assembly worker could perform a particular job within the assembly area. This certification was used to determine what workers could be assigned to various jobs in the assembly area. No post-testing data was available for either the skilled trades or production training.

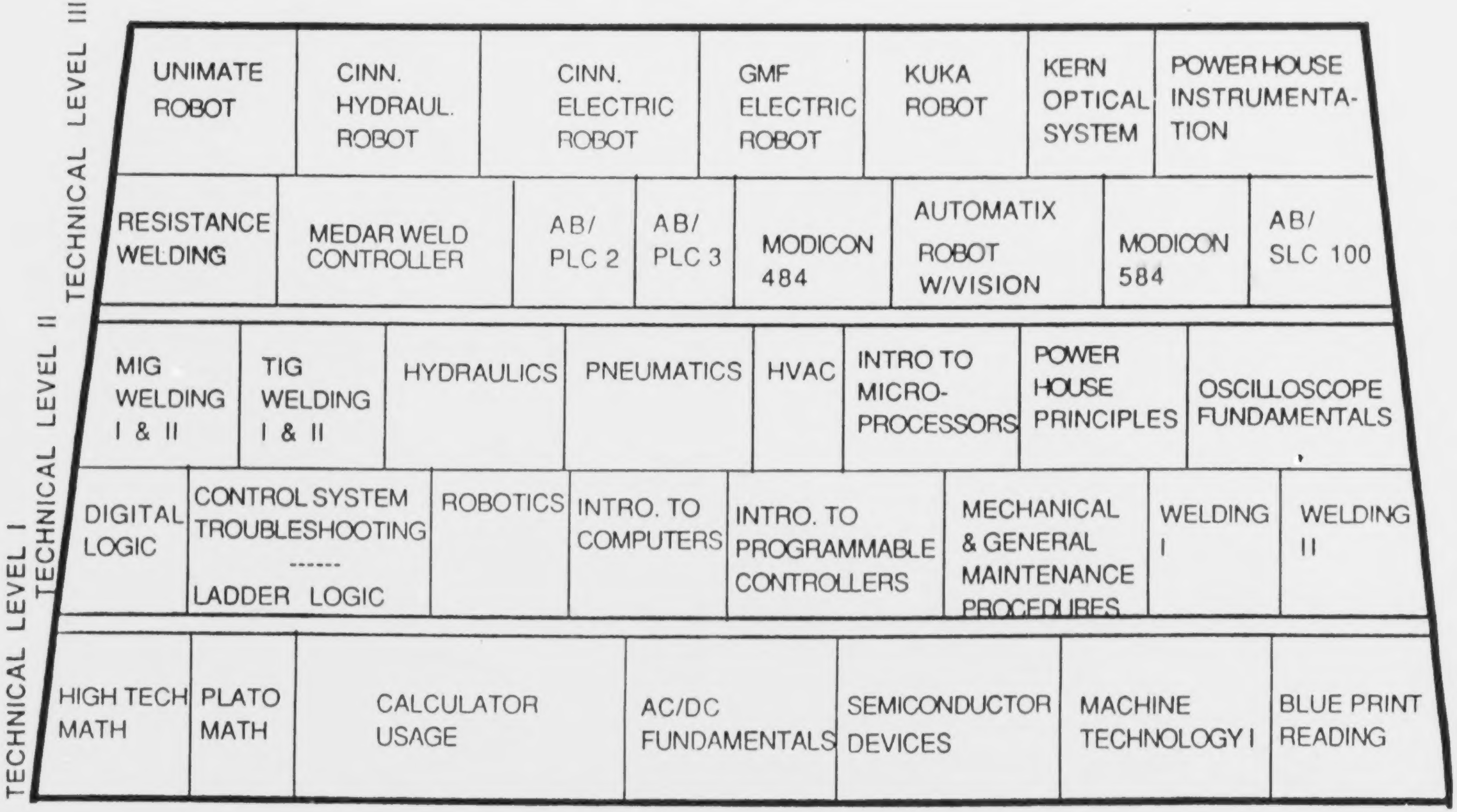
Observations

This case study illustrates how public educational institutions and businesses can work together to develop effective training programs. The training materials developed under this grant have been made available to vocational technical schools in Missouri. It also illustrates the potential linkage between company training programs and vocational certificate programs offerred through public educational institutions.

Second, this case study illustrates how state retraining programs can assist potentially dislocated workers in finding new jobs within a large company. The program was able to retrain these workers without significant unemployment. It also provided an effective mechanism to keep these workers in basic and technical training for about one year.

Figure 1

High-Tech Courses



TECHNICAL LEVEL III

- UNIMATE ROBOT
- CINN. HYDRAUL. ROBOT
- CINN. ELECTRIC ROBOT
- GMF ELECTRIC ROBOT
- KUKA ROBOT
- KERN OPTICAL SYSTEM
- POWER HOUSE INSTRUMENTATION

- RESISTANCE WELDING
- MEDAR WELD CONTROLLER
- AB/ PLC 2
- AB/ PLC 3
- MODICON 484
- AUTOMATIX ROBOT W/VISION
- MODICON 584
- AB/ SLC 100

TECHNICAL LEVEL II

- MIG WELDING I & II
- TIG WELDING I & II
- HYDRAULICS
- PNEUMATICS
- HVAC
- INTRO TO MICRO-PROCESSORS
- POWER HOUSE PRINCIPLES
- OSCILLOSCOPE FUNDAMENTALS

- DIGITAL LOGIC
- CONTROL SYSTEM TROUBLESHOOTING ------- LADDER LOGIC
- ROBOTICS
- INTRO. TO COMPUTERS
- INTRO. TO PROGRAMMABLE CONTROLLERS
- MECHANICAL & GENERAL MAINTENANCE PROCEDURES
- WELDING I
- WELDING II

TECHNICAL LEVEL I

- HIGH TECH MATH
- PLATO MATH
- CALCULATOR USAGE
- AC/DC FUNDAMENTALS
- SEMICONDUCTOR DEVICES
- MACHINE TECHNOLOGY I
- BLUE PRINT READING

■ TRAINING GRANT RECIPIENT:
Glendale Community College
Los Angeles, California

Training Grant

Glendale Community College received a $2,191,734 training grant from the Employment Training Panel for an office automation training program for large and small employers in the Glendale, Los Angeles, and San Fernando Valley areas of the Los Angeles metropolitan area. The largest component of this project involved the retraining of employed workers in various office occupations to use microcomputer equipment and software for word processing, database management, and spreadsheet applications. This training grant was designed to provide retraining assistance for 1,163 employed workers between March, 1987 and January, 1989. The grant paid for the direct training expenses involved in an 18-week, 108-hour course consisting of 36 hours of classroom training and 72 hours of laboratory and/or structured on-site training.

Focus of Case Study

Glendale Community College provided customized training services to approximately 335 small and large businesses under the training grant. This case study was based on site interviews with Glendale staff and three participating companies.

Overview of Company or Industry

In 1985, Glendale Community College saw the need for retraining employed workers in office occupations in microcomputer applications. The college formed a business advisory group to establish a training program that would meet growing business training needs. Based on business input, the college identified the most commonly used software for wordprocessing, database management, and spreadsheet applications. It selected Wordperfect for wordprocessing, dBase for database management, and Lotus for spreadsheet applications.

The Employment Training Panel provided Glendale Community College with a grant in 1985 to train approximately 850 people in microcomputer applications. The project was originally designed for 11 employers. However, about 315 employers participated, a level that showed the strong demand for such a training program. In the second contract with the Employment Training Panel, Glendale Community College served a broad spectrum of businesses in the Los Angeles metropolitan area. Approximately 69 percent of the businesses served were small businesses with 200 employees or fewer. About 11 percent of the businesses employed between 201 and 500 employees with the remaining 20 percent employing more than 500 employees. These businesses were in a wide variety of industries including construction, manufacturing, transportation, communications, wholesale and retail trade, finance and insurance, personal services, professional services, business services, and health services.

Glendale College conducted customized training programs for large companies that enrolled a large number of their employees in the program. Fox Studios and Harman/JBL are examples of large companies that participated through customized training programs. Fox Studios is a television and motion picture studio located in Hollywood, California. Harman/JBL is a large manufacturer of acoustic speakers and is located in Northridge, California. The college also established two centralized training sites for small employers who typically enrolled one or two employees. Triple Check, a typical small employer, provide business and individual tax services and employs five workers. Triple Check sent one employee to a centralized training site.

Competitive Problems Faced by the Company or Industry

Recent advances in microcomputer hardware and software and the lowering costs of this technology for businesses have resulted in large and small businesses in all industries making major changes in how they maintain and process information in office settings. Microcomputer technology provides the opportunity for all businesses to improve their administrative support operations and management information systems. Businesses can improve the quality and responsiveness of management reports used in business decisionmaking through database management and spreadsheet systems. They can lower the operating costs of management information systems including standard accounting and personnel systems. This technology can also improve overall office productivity through the use of database management and wordprocessing software.

For some types of service industries, microcomputer technology provides the opportunity to become more competitive in the direct delivery of products and services to customers. This is most clearly seen in business and professional service industries, especially in small businesses. Small service firms cannot afford custom software from outside vendors. They must use standard database and spreadsheet software to produce their basic products and services.

Strategic and Operational Objectives

The three companies interviewed in this case study provide useful illustrations of how microcomputer applications can be used to achieve strategic objectives in administrative support and management information systems as well as strategic objectives in the production of basic products and services. In order to improve administrative services and lower overall operating costs, Fox Studios decentralized responsibilities for the production of standard financial reports. Fox Studios moved from a large mainframe system to microcomputers using standard database and spreadsheet software. Separate departments within administrative services were responsible for entering, maintaining, and reporting standard financial and accounting information to management. This transition eliminated the centralized data entry and report generation units and required staff in each department to learn microcomputer applications. In addition, Fox Studios introduced microcomputers into all administrative offices. Secretarial and clerical workers were expected to enter and maintain standard information and use wordprocessing software to improve office efficiency.

Harman/JBL also undertook a strategy to improve the overall efficiency and quality of its management information systems by introducing more microcomputers into administrative offices. As standard reporting systems change within the company, administrative staff increasingly were asked to enter, maintain and produce their own reports. This change affected departments with a wide range of functions manufacturing engineering, personnel, finance, and materials purchasing.

Triple Check expected to expand its business and improve the efficiency of its tax preparation service by training its secretary to enter standardized tax information for routine reports to its customers. By enlarging the job responsibilities of the secretary, the three accountants in the business could take on more clients for nonroutine services and expand the company's customer base. It also could insure that routine services would be provided within the same turnaround times and at the same level of quality.

Possible Company Performance Outcome Measures

The strategic objectives of Fox Studios and Harman/JBL in the conversion of the management information systems could be captured through three standard sets of measures.

- **Delivery Time**. Average time between the beginning of data entry to the final production of the management report.
- **Report Costs**. The staff time and costs of the full production of the management report.
- **Report Quality**. Average error rate for management reports.

The more general objectives of improving office productivity through microcomputer applications with wordprocessing and database management software are more difficult to operationalize and measure. However, the companies could establish efficiency and quality performance targets for routine products (reports, contracts, etc.) and services (correspondence) that they expect to achieve through microcomputer applications. This would result in three possible sets of measures: (1) product/service delivery time, (2) product/service costs, and (3) product/service quality. These are similar the the proposed measures listed above.

The strategic and operational objectives of companies such as Triple Check could be operationalized through three types of performance measures.

- **Product/Service Quality**. Average error rates on standard products and services.

- **Product/Service Costs**. Average staff costs in the production of a standard product or service.
- **Product/Service Sales**. Increase in the total sales of products and services produced by individual staff or units or the company as a whole.

Need for Retraining and Training Objectives

The companies receiving assistance from Glendale Community College through the training grant were converting from manual or mainframe systems to microcomputers. This conversion resulted in a change in skill requirements for a wide variety of occupations within large companies. These occupations included professional and managerial occupations as well as clerical occupations (accounting, administrative, collection and claims, general office, and inventory clerk) and secretarial occupations (office management and legal and executive secretarial). Most trainees had little if any exposure to microcomputers and did not have training in wordprocessing, database, or spreadsheet software.

Training Program

The 108-hour training program consisted of 36 hours of classroom instruction, 36 hours of laboratory work, and 36 hours of structured, on-site instruction. In some cases, the training program included 72 hours of laboratory work with no on-site instruction. The program consisted of three separate training tracks. Each one emphasized one of the three skill areas--wordprocessing, data base management, and spreadsheet--depending on the needs of the employer. Instruction was provided six hours per week for 18 weeks. This six hours of instruction included four hours of classroom and laboratory work one day per week. It also included two hours of structured on-site training one day per week or six hours of classroom and laboratory work one day per week.

The training program was divided into approximately 100 classes with 10 to 14 trainees per class. Instruction was provided at employer sites and at the office skills center at Glendale Community College, a satellite college facility in the San Fernando Valley. The word processing track spent 54 hours on word processing, 16 hours on database management, 36 hours on electronic spreadsheet, and 6 hours on DOS. The database management track devoted 12 hours to word processing, 54 hours to database management, 36 hours to electronic spreadsheet, and 6 hours on DOS. Trainees were given handout materials for each classroom session. Classroom and laboratory sessions involved instructional assistants who provided individualized help. Trainees were also given special problems for laboratory and structured on-site training sessions. For customized training programs at the company site, employers were able to tailor the curriculum to best meet their training needs.

Need for State Assistance

Large companies traditionally send employees individually to vendor training centers for introductory training. However, this training is very short-term and is not usually integrated into specific workplace applications. Fox Studios tried this strategy but found that the employees who really needed the training did not benefit from this approach. Neither Fox Studios or Harman/JBL had the internal resources to conduct a systematic training program with the number of employees who needed retraining.

Small companies usually do not have the resources to provide training to office workers. They find it difficult to arrange in-house training or release an employee to enter an external training program. This was the case with Triple Check.

Finally, public educational institutions cannot provide extensive customized training programs for large and small employers without some type of outside funding to purchase the necessary software and hardware and design customized training programs. They also require additional resources to reach and serve large numbers of small employers.

Performance Outcomes

Fox Studios reported that the transition to microcomputers and the customized training program provided by Glendale Community College resulted in significant performance improvements. The most significant improvements were in the Management Information Center. The company reported that standard financial reports were produced with a 25 percent reduction in staff time and costs and a 50 percent increase in accuracy. In addition, the Personnel Department reported that standard scheduling and posting reports were done almost totally by the secretary in about half the time required to do the same tasks before the training.

The training program at Harman/JBL had not been completed at the time of the case study. However, the company did expect benefits especially in the quality and timeliness of management reports and standard administrative support services.

Triple Check reported that the company was sucessful in shifting a significant share of the routine tax reports to the secretary who was retraining. This shift provided the two professional staff with at least one to two days more per month to devote to other clients and types of services.

Training Outcomes

The training program consisted of a competency based curriculum with clearly defined training objectives and measurable competencies for each separate training module. An illustration of these competencies is provided in Figure 1. Trainees were expected to achieve at least 80 percent proficiency to successfully complete the program. The program reported that all trainees achieved this minimal competency, and all were employed 90 days after the end of training.

Observations

This case study illustrates the importance of clear training objectives and measurable competencies for the effectiveness of a customized training program. It also illustrates the importance of integrating classroom, laboratory, and on-site training.

The study also illustrates the potential role of public educational institutions in providing training support to small businesses. The Glendale program is an example of an effective program that serves the training needs of both small and large businesses.

Figure 1
Structured On-Site Training Form

Name: ______________________ Class: ______________

SSN: ______________________

GLENDALE COMMUNITY COLLEGE – EMPLOYMENT TRAINING PANEL
STRUCTURED ON-SITE TRAINING FROM
Word Processing / DOS / Database Management

Week 1 – Multimate Advantage II (week 1 of 5)

PLAN	COMPETENCY	Hrs.	INITIALS Supr.	 Inst.
Introduction to PC and basic DOS commands	Hardware components; DOS functions; list files; check disks; Multimate overview; create, edit, save, and print documents; help screen.	____	________ (/ /) date	________ (/ /) date

Week 2 – Multimate Advantage II (week 2 of 5)

Edit/format text	Page Length; page break; cut & paste; search & replace; set tabs & margins; center; bold; underline; indent.	____	________	________

Week 3 – Multimate Advantage II (week 3 of 5)

Library functions, speller functions, and more editing functions.	Library set up; spell check; spell edit; thesaurus; remove place marks; section numbering; footnote.	____	________	________

Week 4 – Multimate Advantage II (week 4 of 5)

File management	Copy, delete, rename, and move files; print, display, and search summary screens; restore a backup file.	____	________	________

Week 5 – Multimate Advantage II (week 5 of 5)

Merge functions	Set up a merge document and a list document, merge print; special merge commands.	____	________	________

■ TRAINING GRANT RECIPIENT:
Harman International Industries
Northridge, California

Training Grant

Between March 1987 and March 1988, Harman International Industries received two training grants totaling approximately $444,200 from the Employment Training Panel in order to retrain approximately 200 employees in two major divisions, Harman Manufacturing and UREI. Company used these grants as part of a larger effort to improve product quality and lower production costs at its Northridge, California facility. The grants were needed to retrain workers in quality control procedures and the operation of new production equipment, especially computerized numerical control (CNC) equipment in the transducer and furniture divisions of Harman Manufacturing and the new production lines in UREI for first-time contracts to manufacture printed circuit boards for Ford and Chrysler.

Focus of Case Study

The case study focused on the first training grant used to retrain employees in statistical process control. It focused on the implementation and effects of the training in the wood mill of the furniture division of Harman Manufacturing.

Overview of Company or Industry

Harman International Industries, Incorporated, a United States-based corporation formed in 1980, consists of 17 separate companies that design, develop, manufacture, and distribute high quality, high fidelity audio and video system components for home and audio consumer markets, original equipment manufacturers, and professional markets. Harman International companies employ approximately 3,650 people with estimated assets of over $100 million. Harman International is one of the largest manufacturers of high-quality audio products in the United States and offers one of the widest ranges of electronic components from CD players to project television sets. It also manufactures speakers and complete audio systems for Ford and Chrysler. The major audio products of Harman International consist primarily of JBL, Infinity, Pyle, Harman Motive, Epicure, and Audax loudspeakers; Harman Electronics products, JBL and Soundcraft professional electronics; and Harman-Kardon receivers, compact disc players, cassette decks, and other supporting electronics.

Competitive Problems Faced by the Company or Industry

Harman International has grown steadily since 1980 in an industry plagued by low-cost foreign competition through a strategy that emphasizes high quality and product differentiation at competitive costs. In order to implement this competitive strategy, Harman International has pursued three objectives: (1) manufacturing on a highly integrated basis; (2) strong marketing through domestic and foreign sales and distribution channels; and (3) competitive productivity through a balance between state-of-the-art automation and a highly skilled work force.

In order to insure product quality and differentiation, Harman International has established a commitment to "roll their own," that is, produce their own products through highly integrated manufacturing processes and facilities. JBL, Infinity, Pyle, Epicure, and Harman Electronics products are designed and manufactured at the company's facilities in the United States. Harman-Kardon products are designed in the United States and are currently manufactured in Japan under an exclusive arrangement with the Shin Shirasuna Electric Corporation. As part of its commitment to integrated manufacturing, Harman recently enlarged its Northridge facility to create a completely integrated manufacturing operation, including a fully automated machine shop and wood mill. It also reacquired the manufacturing rights to the Harman-Kardon line and is scheduled to begin domestic production at the Northridge facility in the coming years.

The production of high-quality speaker cabinets for the consumer loudspeaker market is central to the competitive strategy of Harman International. Although the company has established clear product differentiation and quality recognition in the loudspeaker market, it has built its reputation largely as a leader and innovator in loudspeaker production and technology. Harman has experienced major problems in remaining competitive in the production of wooden speaker cabinets, especially high-end cabinet models that require greater precision and higher standards of quality. In order to retain strong product differentiation and quality recognition, Harman also must remain competitive in the production of high-quality wooden speaker cabinets that respond to changing consumer tastes and improved acoustics.

One major competitive challenge facing Harman International is to raise the quality standards of traditional speaker lines and restructure manufacturing processes and technologies for the production of new, more complicated speaker designs that require higher precision. This improvement in quality must be accomplished at competitive costs in the face of strong foreign and domestic competition, including competition from American companies with manufacturing operations located in areas with lower facility and labor costs.

The major competitive challenges in the production of wooden speaker cabinets at Harman International have had their greatest effects on Harman Manufacturing. Harman Manufacturing, a company within the Harman International subsidiary, JBL Incorporated, produces transducers and wooden speaker cabinets for Harman International companies as well as outside companies.

Speaker cabinets at Harman Manufacturing are produced by the furniture division at the Northridge facility. The division contains two manufacturing units; the wood mill and the assembly unit. The wood mill contains a series of separate work areas that laminate, cut, detail, and bore the separate parts of speaker cabinets from large wood panels. The assembly unit assembles and inspects the finished cabinets. The mill operates on two shifts which are managed by a supervisor and four to six lead persons who are in charge of the separate work areas.

Between 1981 and 1986, Harman Manufacturing came under strong pressure to improve the quality and costs of the speaker cabinets it produced for other Harman International companies as well as outside companies. Harman customers raised serious concerns about quality, cost, and delivery times. During this period, the furniture division lost money and faced financial problems. Although a large share of Harman Manufacturing's market was other Harman International companies, Harman International allows its subsidiaries substantial discretion in purchasing component parts from outside suppliers if necessary. Harman Manufacturing thus faced the problem of either meeting the quality expectations of its customers (including other Harman International companies) at a competitive cost or being replaced by other foreign or domestic cabinet manufacturers. Harman Manufacturing had to improve quality and reduce costs through a major upgrading of manufacturing equipment, through restructuring production processes and quality control procedures, and through retraining workers.

Strategic and Operational Objectives

One major initiative Harman Manufacturing undertook in 1986 was to change quality control activities in the mill operation from detective or final-inspection procedures to in-process procedures through the use of statistical process control (SPC). At its most basic level, SPC is a set of statistical tools used increasingly by American manufacturers to identify, diagnose, and solve production problems. These tools attempt to distinguish between common and special variation in the output of separate stages of the production process. Common variation in the attributes of particular outputs or parts of the final product reflect the natural variability of the production process and are given special boundaries or limits based on the tolerances (acceptable levels of variation) allowed in the product design. Special variation (variation outside expected boundaries) is assumed to reflect correctable problems in the production process including material or input problems, errors in machine setup, excessive wear in machine tools, and inadequate operator skills.

The primary SPC tool for distinguishing between common and special variations is the control chart (Figure 1). An upper control limit (UCL) and a lower control limit (LCL), indicate the boundaries of common variation that are allowable according to product tolerances. A production process is considered in statistical control when the points plotted on the control chart fall randomly within the upper and lower boundaries. For most American manufacturers, SPC is more than just a statistical technique for monitoring the production process. It represents a broader business philosophy that considers each employee responsible for the quality of his or her work. It provides each machine operator with the ability to understand his or her own part of the production process and identify and correct problems on a continuous basis. SPC establishes a common language and tool for technical staff, production supervisors, and machine operators to use together in a continuous program to improve quality.

Possible Company Performance Outcome Measures

The SPC training program at Harman Manufacturing was one component of a broader quality improvement program within the wood mill operation of the furniture division. The objective was to make the product right the first time. It was an effort to make speaker cabinets with higher quality standards at a competitive cost through in-process control mechanisms that had the capability reducing scrap costs and rework time.

SPC procedures are instituted in manufacturing plants to reduce quality failure costs as measured through:

- **Material Scrap Costs**. Material costs of products scrapped because of variance with quality standards.
- **Rework Costs**. Extra labor costs incurred because of repair or rework of final products or in-process components.
- **Customer Returns.** Material and labor costs of returned products.

SPC procedures also are expected to have positive indirect effects on overall manufacturing efficiency and capacity as well as inventory costs as measured by:

- Work-in-progress inventory costs.
- Raw inventory costs.
- Direct labor costs.
- Plant capacity.

As is true in almost all quality improvement efforts, the implementation of SPC procedures at Harman Manufacturing was only one part of a broader quality improvement program that included improvements in material quality and handling, material routing and machine utilization, machine maintenance, shift reorganization, and the implementation of a just-in-time delivery system. In addition, since Harman Manufacturing constantly introduces new cabinet models that may affect aggregate measures of quality failure costs as well as more indirect measures of plant efficiency and performance, the most appropriate and reliable indicator of the effects of SPC training on company performance was the reduction in scrap costs and rework time.

Need for Retraining and Training Objectives

The SPC program at Harman Manufacturing required the retraining of machine operators, lead persons, supervisors, and engineering support staff because all mill employees needed a common language and diagnostic tool to identify and correct production problems before they resulted in large scrap and rework costs. SPC procedures were designed to give machine operators the capability of stopping production and the responsibility to do so when cabinet components were not produced within tolerances allowed by the product design. These procedures required machine operators to complete SPC charts on an hourly basis and report special variations to supervisors. In order for them to work successfully within an SPC program, most mill employees needed specialized training in statistical process control as well as more general training in quality control and statistics.

Training Program

In consultation with Harman management, TRT Systems, a California-based company specializing in SPC training, designed a 100-hour, eight-week training program for three separate class groups consisting of 26 or 27 trainees each. The training program started with an introduction to quality control and SPC in the first week. This included a discussion of the quality control philosophy and the importance of quality control procedures in remaining competitive. The second week was devoted to problem-solving techniques, cause and effect diagrams, and data collection strategies. The third and fourth weeks involved basic statistical training including scatter diagrams, averages, standard deviation, and basic probability theory. The next three weeks were devoted to training in basic, intermediate, and advanced control charting and analysis. The final week addressed process capability analysis, quality planning and implementation strategies, and conformity to government and other customer quality requirements.

The program was designed to provide trainees with instruction in general education as well as training in SPC procedures and to enable trainees to apply their training to new SPC quality control procedures in the mill operation. Trainees were given a specially prepared training manual with a reference guide, which was a widely used guidebook for SPC from Ford Motor Company. They were also given exercises to do on the job with individualized assistance and supervision in this on-the-job compoment provided by TRT Systems.

All SPC training was conducted during normal working hours, and trainees received their regular wages. In order to meet production schedules and allow for sufficient classroom training and on-the-job instruction, some production shifts were given overtime pay. This shift overlap and overtime arrangement was continued througout the training period at considerable cost to Harman Manufacturing. However, site interviews with management and trainees indicated that this arrangement was necessary for the effective planning and delivery of the training program.

Need for State Assistance

Because of tight production schedules and budget constraints, Harman management first introduced SPC-based monitoring and problem-solving in the quality assurance unit, a technical support unit at Harman Manufacturing. The manager of the quality assurance unit provided his staff with reading materials and informal instruction in

SPC procedures and established some centralized, in-process quality control procedures in the mill.

Within a few months, Harman management concluded that the potential quality improvements from SPC procedures would be realized only if all mill employees were extensively trained in SPC procedures and were responsible for the quality of their own work. Harman managers responsible for the quality improvement efforts developed cost estimates for a comprehensive SPC training project for all mill employees and presented a proposal to upper management for consideration.

Budget constraints and the fact that such a large training project was unprecedented at Harman Manufacturing prevented any immediate implementation of an SPC training project for all mill employees. Harman Manufacturing at that time was losing money at the mill, and the company already had obligated existing funds for major capital expenditures and other facility improvements. In addition, retraining of this type was not a normal expense and could not be easily incorporated into the company's training budget, which was set up to handle the recurring training costs involved in employee development.

The availability of funds from the Employment Training Panel to pay for the direct training costs of a full-scale implementation of SPC was one major factor in the decision by Harman Manufacturing immediately to undertake a comprehensive SPC training program for all mill employees. Although Harman managers indicated in site interviews that Harman Manufacturing eventually would have gone forward with SPC training without state funding, they also indicated that the grant provided the necessary resources to begin the project six to eighteen months sooner. Based on our interviews, it appears that the grant did have a significant effect on the scope and timing of the SPC training program.

Performance Outcomes

Management and workers at Harman Manufacturing both felt strongly that the SPC training program had significant effects on the performance of the wood mill. They felt that the largest and most direct effects of SPC procedures were the observed reduction in scrapped products in the mill. Before the quality improvement efforts, scrapped products were noticeable throughout the mill. The quantity of scrapped materials was so large that it required extra workers to remove scrap from the mill and prepare it for disposal. After the quality improvement efforts, managers and workers observed a substantial reduction in scrap in relation to the quantity of goods produced in the mill.

Harman Manufacturing evaluates manufacturing performance in part by assessing changes in actual direct costs of materials and labor relative to a standard cost estimate or benchmark. Variances between actual costs and the benchmark are reported on a monthly basis. Before the quality improvement efforts, the wood mill operated at a substantial loss because of cost overruns (i.e., variances from cost standards) in material and labor on a number of cabinet models. After the training program, both material and labor variances declined substantially both in total costs and costs per unit of produced goods. The most dramatic changes were in material costs. Harman reduced

material variances in the mill operation by approximately 60 percent in the four-month period following the completion of the training program.
These trends do not establish that SPC procedures were the major cause of the cost saving. However, they do provide some evidence that SPC training was part of a successful quality improvement effort to reduce material variances (in particular, scrap costs) and to maintain the quality standard and cost structure at the mill that was needed to be competitive in the consumer speaker cabinet market.

The production process within the mill is divided into four to five major stages involving over 30 separate work stations. SPC procedures were established to collect control data for individual machines used at various stages of the production process. Lead persons and machine operators were given the responsibility for using SPC procedures to monitor and correct production problems at their respective work stations.

Material routing information in conjunction with more detailed breakouts of scrap costs could produce information on scrap reduction at individual work machines, work stations, or stages in the production process (e.g., boring, detailing) where the SPC procedures and traiing should have their greatest impact. However, at the time of the case study, no information was available on scrap costs or any related performance indicators at the work unit level. Harman managers at the mill were interested in establishing this performance information in the future.

Training Outcomes

The major problem experienced in the implementation of the SPC training project was how to deal with the limited English of some Hispanic workers in the mill operations. This problem was encountered in the first week of training and resulted in some early dropouts. However, some Hispanic workers with limited English were able to work through the SPC training program with the assistance of other Hispanic trainees who were going through the training at the same time.

Although the SPC training program did have specific objectives and clearly designed modules, Harman and TRT Systems did not conduct formal pre- and post-training tests. The trainees who were interviewed at the site visit reported that almost all of the trainees who completed the program could do the required SPC charting for their jobs. However, no systematic data exist on competencies of individual workers.

The SPC training program was clearly written as an introduction to SPC charting and control. It was built from a foundation of basic concepts and statistics and integrated into specific work responsibilities defined by mill supervisors.

The program could have been evaluated from two different types of competency tests: (1) paper and pencil tests on basic terms and concepts and SPC charting procedures, and (2) demonstrated performance of job responsibilities and work tasks in SPC charting and problem-solving. Performance testing probably would be the best predictor of work unit or company performance.

Observations

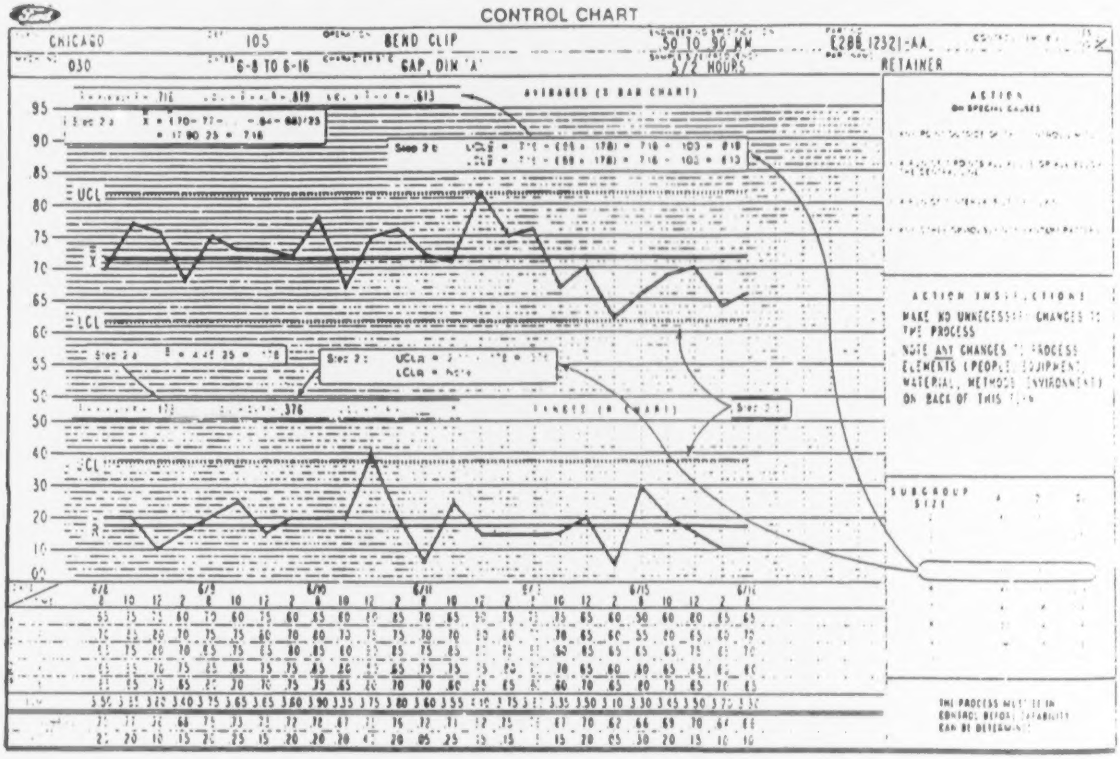
The SPC training program at Harman Manufacturing underscored the importance of combining general skill training with hands-on problem-solving in job-related or job-specific applications. This approach seemed to fill the need for trainees to see the connections between general concepts and procedures and their future job responsibilities.

The SPC training program also had a positive effect on how managers and workers viewed the responsibilities and capabilities of machine operators. Trainees reported greater satisfaction with and control over their jobs after they were given greater responsibility in SPC charting and problem-solving. In addition, managers reported greater confidence in the capabilities and commitment of mill workers in using their training to improve company performance.

The SPC training project established a clear success story in the company which, in turn, provided a solid foundation for future training investment. Since the training project, Harman Manufacturing has hired a full-time training manager and increased the training budget.

Figure 1

SPC Control Charts and Monitoring Productiion Processes



Source: Continuing Process Control and Process Capability Improvement (Corporate Quality Education and Training Center, Ford Motor Company, December, 1987).

■ TRAINING GRANT RECIPIENT:

Ingersoll Milling Machine Company

Rockford, Illinois

Type of Training

Ingersoll Milling Machine Company received a $39,096 grant from the Prairie State 2000 Authority in May 1987. Training occurred in geometric tolerancing and dimensioning, a symbolic language used to communicate design specifications in terms of the functional requirements of each design feature. Training occurred in classroom settings. The length of training and the level of skills required of individual workers varied by job function. The state grant covered 50 percent of the direct training costs including fees paid to the trainer and educational materials such as workbooks.

Focus of Case Study

The case study focused on the effects of training in geometric tolerancing and dimensioning on company performance objectives in improving quality control.

Overview of Company or Industry

The Ingersoll Milling Machine Company, founded in 1887 and based in Rockford, Illinois, and employing 1,800 workers, designs and manufactures special machine tools and automated manufacturing systems. It operates businesses in Troy, Michigan and Northampton, England. Also, it is one of four companies under the Ingersoll name. The other three companies are Ingersoll Cutting Tool Company in Rockford; Ingersoll Engineers Incorporated with offices in the United States, England, France and West Germany; and Ingersoll Maschinen und Werkzeuge GmbH in Burbach, West Germany. Other companies in the Ingersoll family are the German firms Boehle, Walldrich Siegen and Walldrich Coburg.

Ingersoll, with yearly sales reaching $300 million, is privately held and is one of Rockford's biggest, oldest, and most respected companies. It ranks among the ten largest machine-tool companies in the world. The majority of its business is from the production of large-scale, custom-made machines and machining systems for firms such as Boeing, Caterpillar, Cummins Engine, Chrysler, Ford, and General Motors. Ingersoll also produces some standard industrial machines and machine tools, drilling machines, milling machines, transfer machines, and machining centers.

Ingersoll has shown a consistent pattern of investment in new technologies and information systems. Approximately 80 percent of Ingersoll's metalworking machines are fewer than 5 years old, and most of the rest are fewer than 10 years old. Also, Ingersoll began working with computers for design and production in the 1970s, with the purchase of a Lockheed software program. Now it operates entirely with an integrated CAD/CAM system.

Edson Gaylord, chairman and principal owner of Ingersoll, has run the family of Ingersoll businesses for 20 years. He is well known in the machine building business as staunchly opposed to protectionism, believing that government intervention will prevent much-needed industry reform. He has fought foreign competition by taking a long view on the returns that may be achieved by new capital investment (something that he attributes to Ingersoll's being a privately held company) and by embracing strategies that are successful for his competitors (e.g., the Japanese attitude of building partnerships with Ingersoll's clients on their projects).

During the recession of 1981-82, sales within the machine-tool industry and at Ingersoll dropped dramatically. Ingersoll continued to lose money through 1985 (e.g., in 1983 it lost $15 million) and earned only minor profits in 1986 and 1987. In order to keep its competitive position during these periods of financial difficulty, Gaylord drew heavily on local Rockford banks to support Ingersoll operations. At one point he put his house up as collateral in an effort to secure additional resources. As a consequence of these efforts, Ingersoll was able to keep much of its labor force and to make significant technological improvements. This has positioned the company well for future growth.

Competitive Problems Faced by the Company or Industry

Competition in the machine-tool industry in the United States is very strong due to a general decline in demand for metalworking machines and rapid globalization of the industry. This is true particularly for manufacturers of standard machines. Ingersoll occupies the very specialized niche of making custom-designed machine tools and manufacturing systems. As a consequence, only a handful of businesses worldwide have the resources to manufacture the mammoth machines and systems demanded by Ingersoll's customers. Nevertheless, it faces stiff competition in giving its customers technologically advanced systems and machines within tight time and budget constraints.

Although product quality always has been one of Ingersoll's strong competitive features, customer demands shifted during the 1980s. The automotive industry in its push for higher quality vehicles placed higher demands for tighter tolerances on the machine tools that it was purchasing. Ingersoll discovered that the design language it used was inadequate in that it hampered its design engineers, production personnel, and quality assurance staff in their efforts to produce metalworking equipment that would meet the stiff requirements of their customers. In addition, Ingersoll customers also were adopting geometric tolerancing and dimensioning conventions of the American National Standards Institute (ANSI) as a means to describe the critical features of their own components. Although Ingersoll was able to respond by adopting these standards for its customer relations, it operated internally with a design language that had evolved within the company over many years. Consequently, customer needs expressed in ANSI standards would have to be reinterpreted in Ingersoll language before design work could begin.

During 1986, Ingersoll Milling Machine Company became concerned about the number of items that failed initially to meet quality inspection. Upon review, Ingersoll management learned that as much as 50 percent of the products that received defective work tickets were rejected because they did not meet blueprint specifications. However, these items were perfectly functional and were well within the required tolerances. Management then discovered that the method for describing the specifications for each component part often led to poor communications between the design engineer, the production workers, and the quality inspectors. For instance, a design engineer would stipulate very tight tolerances on a given machining operation even though there might be no functional purpose to those tolerances. The production workers, understanding this, would machine the part so that it was functional but was outside the tolerances stipulated in the blueprints. The inspector then would state that the part was defective, although it was good enough to be used in the final product. This arrangement added significantly to the costs of manufacturing. Management responded by adopting the symbolic system for expressing geometric tolerancing and dimensioning of the American National Standards Institute. The system permits the designer to convey a clear understanding of the ideal geometry of the part and to express in functional terms the extent to which the actual geometry of the part may vary.

Strategic and Operational Objectives

In order to meet added competitive pressures along the dimensions of price, quality, and customer satisfaction, Ingersoll adopted in the fall of 1986 the Critical Business Issues Program that was designed to generate a 40 percent reduction in the cost of doing business by 1990. The seven components of the program were:

1. **Customer Orientation:** Creating relationships that instill confidence and meet need.

2. **Quality:** The process of continuous improvement in all work.

3. **People Development:** Attaining maximum career contributions from everyone.

4. **Project Management:** Using Ingersoll resources effectively and efficiently. Ingersoll defines project management as "the effort directed solely at the success of one project which provides cross-functional integration of project decisions, events, and activities starting from the first day and concludes with full or normal production in the customer's facility."

5. **Participation in Management:** Promoting the widest involvement in producing the best decisions and the greatest individual commitment.

6. **Strategic Planning:** Aiming at the right things. Ingersoll defines strategic planning as "an ongoing process of evaluation which identifies the strengths and weakness of the organization, [its] market position, [its] products and the

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current business environment." It involves an analysis of weakness, opportunities, threats, and strengths, and it generates a vision of where the company wants to be, after establishing where the company is positioned with its products, people, and planning. Finally, the organizational assessment must be translated into goals and objectives for the business to pursue.

7. **War on Waste:** To abhor waste was to become a community commitment. Ingersoll defines waste as anything that prevents the company from operating at a minimum cost and any time that efforts exceed value added.

The problems experienced with respect to defective work tickets were viewed as violating the quality and war on waste components of the Critical Business Issues Program. Adoption of the ANSI geometric tolerancing and dimensioning system was viewed as a means of improving quality and reducing waste. In addition, Ingersoll executives thought that the uniform application of the system would improve communications among company personnel, reduce scrap and rework costs, ease the relationship between manufacturing and inspection, and improve Ingersoll's relationship with its customers. Finally, the geometric tolerancing and dimensioning system was viewed as a necessary precursor to emerging manufacturing technologies.

Possible Company Performance Outcome Measures

Ingersoll staff identified two measures that indicated the problems that management wished to address through geometric tolerancing and dimensioning. First, management sought to increase the percentage of parts accepted the first time. Second, management sought to decrease the number of defective work tickets. In addition to the measures cited by management, it is possible that the adoption and uniform application of geometric tolerancing and dimensioning may result in a shortening of the design-through-manufacturing cycle by reducing uncertainty over manufacturing specifications and thereby lowering rework costs.

Need for Retraining and Training Objectives

Once it was decided to adopt the ANSI geometric tolerancing and dimensioning system, management determined that all personnel who would have to make use of the system would need to be trained in it. It was assumed that some personnel had been educated in the system; however, it was not cost effective to customize the training to suit the exceptional cases where the worker already was proficient in geometric tolerancing and dimensioning.

Prior to the involvement of the Prairie State 2000 Authority, Ingersoll established a pilot training committee consisting of personnel from each of the departments that would be required to use the new system. The committee made its recommendations to management regarding a process for integrating the system in Ingersoll operations by identifying the categories of workers who would receive training and the level of skill that each category would have to attain. For instance, workers such as production personnel would need only to comprehend the language. Workers such as design engineers would have to articulate their ideas using ANSI geometrics as well as

comprehend the meaning of such drawings. The latter group required a more comprehensive training program than the former.
Specific comprehension tests were developed by Ingersoll personnel to assess whether workers completing the training would be able to function in the new symbolic language environment. These comprehension tests also were used as informal pre-tests because they permitted the instructor to identify a starting point for a given class.

No formal tests were developed to assess the ability of workers to articulate their ideas in terms of geometric tolerancing and dimensioning. Functionally, these workers had to achieve a level of proficiency that would enable them to design a part and express it symbolically in accordance with ANSI standards. In practice, Ingersoll could feel secure that the workers completing this aspect of the training could speak the language fluently. The training itself required workers to work through several simulated design problems, and their performance was critiqued by the instructor.

Description of Retraining Program

Training occurred in two stages. The first stage, the comprehension stage, involved 24 hours of classroom lecture and some group exercises over six days. The second stage, during which workers were taught to express themselves in terms of geometric tolerances and dimensions, involved another 24 hours of training. However, this period of training was devoted purely to the application of the system.

Training occurred in groups drawn from personnel in several departments. The purpose to be achieved by mixing personnel was to expose workers at various phases of the manufacturing cycle to the views of their colleagues. The intent was to instill a greater sense of teamwork and to establish lasting relationships that may be called upon by any one of the workers when dealing with a problem involving one or more other departments.

Initially, all training was provided by an outside vendor. However, the training for workers only needing to comprehend the system was transferred to the training department of Ingersoll.

Need for State Assistance

The state's assistance was required for two reasons. First, although company officials acknowledged that training in geometric tolerancing and dimensioning was a necessary condition for its successful implementation, they were hesitant to undertake such a comprehensive and concentrated training program. The state's assistance helped to justify the program. Second, the company also was able to show financial need by certifying that it had been unprofitable in three of the previous four years and that it was operating at a loss at the time it made its application to the state.

Performance Outcomes

Ingersoll officials reported that the number of parts accepted initially had increased by 20 percent over 24 months. At the time the report was made, training had commenced approximately 22 months before. They indicated that most of the improvement was attributable to better communications throughout the design and manufacturing process. "The common understanding between departments and clear functional relationships of features are the major reasons. These improvements can be directly related to the geometric dimensioning and tolerancing training program."

Another area targeted for improvement was the incidence of defective work tickets, but these data did not improve. Company officials attributed this result to a coincidental change in the policies of the Inspection Department leading it to inspect more features and a shift by Ingersoll to building higher-precision parts. Consequently, more parts were likely to be considered defective.

Training Outcomes

A review of pre- and post-test scores for one class showed that scores increased an average of 38 percent. Workers averaged 55.22 on the pre-test and 89.55 on the post-test. Another class showed a 90 percent increase, with and initial average score of 8.66 and a final average score of 84.15. No records were kept about the workers' ability to express their ideas in ANSI symbols.

Observations

Participants in the training program reported that a significant result stemming from the adoption of geometric tolerancing and dimensioning and from the structure of the training was that communications between workers at various steps of the manufacturing process eased considerably. In addition, workers viewed the new blueprints as credible because they correctly and cogently described the machining functions to be performed.

■ TRAINING GRANT RECIPIENT:
KLM Industries, Inc.
South Chicago Heights, IL

Type of Training

KLM received a $14,494 training grant and an additional $14,494 training loan from the Prairie State 2000 Authority in December 1988. Production personnel received training in quality control, measurement tools, product mix, equipment and material handling, techniques in lumber yield improvement, basic first aid, safety, quality improvement teams, management by objectives, quality management control, computer training, and craftsmanship. Marketing and financial management training included courses on the use of personal computers and the use of specific accounting, inventory control, and production scheduling software. Other management and financial training covered management by objectives, RPS management information procedures, blueprint reading, product mix knowledge, interior design, and business planning.State funds were used to cover one-half of the cost of KLM personnel who conducted the training.

Focus of Case Study

The case study illustrates the role of state training funds in addressing a wide range of performance problems in administrative and production functions.

Overview of Company or Industry

KLM Industries, Inc. is one of six or seven businesses that serve the Chicago area millwork market. It is a privately owned wood milling company operating several divisions including Muench Woodworks (pre-hung doors and interior trim), Specialty and Custom, RPS (a wood moulding manufacturer), and Top Notch (a recently acquired kitchen cabinet manufacturing and installation business). KLM was organized in the spring of 1988 from the almost bankrupt Muench Woodworks. The Specialty and Top Notch divisions of KLM were not directly involved in the training.

Competitive Problems Faced by the Company or Industry

KLM serves a broad variety of markets in the Chicago area, and each presents its own set of competitive problems. The original business, Muench Woodworks, sells to wholesalers and construction businesses. Price is a key factor in competition; however, quality and customer service also serve as major competitive issues. RPS, the wood moulding business, serves Muench Woodworks and wholesalers. In addition, Muench sells some specialty products to Muench competitors. The moulding business is sensitive to price and the ability of the company to make deliveries on time. In light of the severe price and time pressures in the millwork industry, companies are compelled to keep overhead costs to a minimum and to maximize cash flow by streamlining internal accounting and management operations and by maintaining optimal levels of inventory.

Strategic and Operational Objectives and Associated Actions

The near failure of Muench Woodworks resulted in part from the company's lack of effective accounting and inventory management systems. KLM resolved to correct these problems by developing a financial management system that would (1) improve cash flow by improving performance on receivables, (2) lower costs by monitoring expenses and payables more closely (even taking advantage of discounts whenever feasible), and (3) by computerizing the payroll systems.

Production operations under the old Muench company were hampered because management did not have timely and accurate information on production schedules and on current inventories. As a consequence, company sales people were often uncertain whether the company could meet customer demands on price and time of delivery.

The company recognized that certain cost centers, if left unmanaged, would continue to sap the strength of the business. KLM management determined that workers' compensation costs and production losses due to lost time injuries needed to be lowered significantly.

Finally, KLM sought to reduce costs and improve production quality by making more efficient use of its raw materials and by improving production operating speeds. It purchased moulding equipment based on computer numerical control technology and re-engineered its production operations to achieve quality and efficiency objectives.

Possible Company Performance Outcome Measures

Marketing and Financial Management. It was expected that computerizing financial management and production scheduling systems would produce the following results: (1) reduce the age of receivables; (2) improve the percentage of receivables collected, and (3) produce savings in payables due to better management of product discounts, more accurate counts on inventory, more accurate job costing as indicated by a reduction in the variance between optimal and actual cost quotes, and better production scheduling as indicated by a reduction in inventory carrying costs and improved performance on achieving production deadlines.

Production: The production training was expected (1) to improve lumber yields (by improving quality and using raw materials more efficiently), (2) to decrease downtime

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due to equipment failure in Muench and RPS (improved maintenance), (3) to reduce the rate of time lost from injuries, and (4) to improve throughput.

Need for Retraining and Training Objectives

The reorganization of Muench Woodworks into KLM Industries, Inc. required a complete and sudden reordering of management and production activities. Management determined that the most efficient way to accomplish this was to identify several key areas for remedial action and to train all personnel in the shortest practical time in the aspects of KLM operations. As a consequence, an internal management consultant developed a comprehensive training program based on specific training objectives. Specific objectives of the training program and the expected levels of skills attainment are as follows.

Management and Administrative Training. One objective was to train key personnel in the new management information system. These personnel were expected to input information accurately into the system and to generate routine and special reports.

A second objective was to train bookkeeping and accounting personnel on the new computerized accounting system. These personnel were expected to input information accurately, to generate routine and special reports, to analyze financial information and to make recommendations on the management of cash resources, to operate the payroll system quickly and accurately (including payment of withholding, social security, and unemployment insurance taxes), to enter orders and generate job cost estimates, and to issue purchase orders.

Production Training

- **Management Information System**. The objective was to familiarize all RPS employees with the management information system, the flow of paperwork, and the RPS procedures.

- **Muench Woodwork Procedures**. The objective was to familiarize all Muench Woodwork employees with Muench procedures, work flow, the effect of customer orders on production activities, and the importance of employee involvement in following proper procedures.

- **RPS Inventory Control**. The objectives were to train the moulding division workers in inventory control procedures, to provide them with an understanding of the inventory control system, and to demonstrate the effects of the inventory control system on controlling inventory costs.

- **Specialty Department Material Control**. The objective of the training was to address the need for keeping track of material and the storage of material used by the specialty department. Elements of the training included instruction on the use of color-coded charts indicating categories of stored materials and an identification sheet for material that the specialty department can return to RPS for credit.

- **RPS Production Goals**. The overall objective of this phase of the project was to communicate the goals and objectives of the RPS (moulding) division so that production employees would have a general understanding of the areas that had been improved and those that required improvement. Training presented the company's vision, the goals and objectives that formed RPS's short-term planning as they related to the March 1989 income statement, the areas where productivity needs to be improved, the company incentive plan, and the training and employee development programs that are planned to help employees reach the company's goals and objectives.

- **Muench Woodwork Production Goals**. The overall objective was to communicate the goals and objectives of the Muench Woodwork division so that production employees would have an overview of the areas that had been improved and those that required improvement. The training followed the same pattern as that for production training in the RPS division.

- **Material Handling, Tagging and Movement**. The objective was to train all RPS personnel in the handling, tagging, and movement of material from receiving to the bundling section.

- **Duty Roster--Delivery Target Day**. The objective of this training activity was to explain the procedures associated with setting material delivery dates in accordance with the five-day duty roster.

Equipment Training. The objectives of training in equipment covered the following areas.

- **Straight-line ripsaw, cut-off saw, bandsaw, hand shaper**. The objectives were to train new workers and to refresh the skills of experienced workers in the safe operation of these pieces of equipment.

- **Compu-ripsaw demonstration**. The objective was to demonstrate the applications and operations of a new piece of equipment, which makes use of the latest technologies.

Safety Training. Training in safety covered three areas. The objectives were as follows.

- **American Red Cross Multimedia Standard First Aid Training**. The objective was to train workers in the provision of immediate emergency care.

- **Truck Driver Safety Training**. The objectives were to inform vehicle operators of the importance of safe driving practices and driver responsibilities, to provide them with procedures for preventing loss, and to train them in the procedures for filling out the daily delivery schedule.

- **Fork Lift Safety Training**. The purpose was to introduce fork lift operators to their responsibilities for safe operation of fork lifts. The training also updated and reviewed fork lift operations. Workers were tested on their knowledge of fork lift operations at the conclusion of training.

Quality Control Training. Training in quality control covered a wide variety of policies and procedures.

- **Reading a Ruler for Quality Control.** The objectives were to instruct production employees on the proper method for reading rulers and in the use of rulers in quality control.
- **How to Read a Dial Caliper.** The objectives were to train production employees in the techniques of reading a dial caliper and in the use of the dial caliper in quality control.
- **Material Defect Identification.** The objectives were to train workers to recognize defects in materials as they are finished at each work station and to prevent the shipment of defective products by withholding them from finished inventory.
- **Rejection and Disposition Tags--RPS Division**. The objective was to train RPS production personnel in the procedures associated with the implementation of rejection and disposition tags.
- **Process Control and Variance.** The objective was to explain to production personnel the use of the bell curve as a method for indicating whether a process is in control.
- **Costs Associated with Poor Quality:** The objectives were to describe the costs associated with defects that can be controlled by improving machine operations and human performance.
- **Introduction to Quality Control Planning.** The purpose was to inform KLM personnel of the need for a quality control program at the company. It also introduced the quality control inspection points and process and established a quality control unit for each division.

Craftsmanship Training. The objective was to inform employees about the terms, applications, and installation of KLM products. The purpose was to develop a sense of craftsmanship and pride in KLM's finished products.

Training Program

Training was accomplished in four ways. Management and administrative personnel learned the accounting system in a structured, on-site training environment. Training was provided by the manager of the management information system.

Production, quality control, and craftsmanship training were provided by KLM Industries personnel generally in a classroom environment. The caliper and ruler reading courses were taught in a classroom. Workers receiving such training had to pass a written exam in order to complete the course.

Equipment training was provided in a classroom environment by KLM personnel. The program used video tapes for the course content, a printed study guide for competency testing, and on-the-job training. It was designed by the Ontario Furniture Manufacturers' Association.

Safety training was conducted under contract with the American Red Cross. It involved a multimedia presentation on safety techniques and on-site practice training.

Need for State Assistance

KLM Industries, Inc. was the successor to a near-bankrupt millwork company. The company lacked the resources to finance a comprehensive training package.

Performance Outcomes

The company did not provide specific information on its performance related to its training activities. It did, however, give examples of the changes that had occurred since the completion of training. Administrative and executive personnel reported that the new accounting and management information systems substantially shortened the time it took to produce an accounts receivable aging report and added new reports (e.g., monthly statements, collection reports, and a cash requirements statement). The addition of this timely information has made it possible for management to project end-of-month balances.

Sales increased as a consequence of the improvements made by KLM. Employees making contact with customers can now take orders and commit to a shipping schedule within one day because they have current information on available inventories.

Inventory control has improved immensely. Previously, inventories were taken by physical count every month. Currently, production managers are able to determine immediately such matters as the amount of inventory that is in process, the amount of finished goods in inventory, and who processed the inventory. In addition, accuracy has been improved so that there is no more than a 2 percent error rate.

Production has improved on certain machines. Previously, it took up to two months for a newly hired worker to become proficient on a moulding machine. The addition of a formal training program has been associated with a 50 percent cut in the amount of time that it takes a new moulder to achieve good productivity.

Safety training has been credited with a reduction in loss of time from accidents and a lessening in the severity of accidents when they occur. Currently, most accidents are considered to be minor.

Training Outcomes

Although KLM established learning objectives for each phase of the training project, it did not document their attainment. In a few aspects of the training program, KLM formally asked that the workers demonstrate their skills and knowledge in the areas in which they had just been trained. For instance, workers were asked to demonstrate that they were able to read a ruler or caliper. Also, workers who finished safety training were certified by the Red Cross for successfully completing the program.

■ TRAINING GRANT RECIPIENT:
Lawrence Box and Basket Co., Inc.
Cobden, Illinois

Training Grant

Lawrence Box and Basket Co. received a $1,045 training grant from the Prairie State 2000 Authority in May 1988 to train an employee in the operation of new basket making equipment. The state grant covered 50 percent of the cost of the trainer.

Focus of Case Study

The case study addressed how the training was used to achieve the company's performance objectives with the newly purchased basket-making equipment.

Overview of Company or Industry

Lawrence Box and Basket Company, Inc. employs approximately 13 people. It has been in operation since 1903 producing rough wood veneers, baskets for the fruit and vegetable industry, baskets and other wood veneer products for the arts and crafts industry, plant bands for seedlings, and baskets for floral arrangements. The company is owned by three brothers, grandchildren of the founder, who took over operation and management of the firm in 1984.

The company began operations as a producer of stack barrels. In 1920, it began to experiment with other types of baskets and crates. By 1926, it was producing saw bushel baskets. The company and its markets continued to evolve so that by 1935, it was producing baskets that were smaller than bushel size. During the 1940s and through the 1960s, it concentrated on producing baskets for the fruit and vegetable industry. In 1967, the father of the current owners and son of the founder decided to shut down the company except for very limited production runs using only the veneering machine.

In 1984, the current owners and operators decided to reopen the company. During the first calendar year (11 months of operation), the company grossed $10,000 primarily by concentrating on the fruit and vegetable market. In 1985, they expanded the company's territory, and sales quadrupled to $40,000. In 1986, they further increased their market area and began to explore the arts and crafts trade. This increased sales by 150 percent to approximately $100,000. The company has continued to expand its market area and the diversity of its products, resulting in sales of $170,000 in 1987 and over $200,000 in 1988.

Competitive Problems Faced by the Company or Industry

There are no other producers of wood baskets in southern Illinois. Nationally, the number of basket manufacturers declined from 1,000 in 1967 to just 22 in 1984. Lawrence Box and Basket competes in the western Ohio River valley and central Mississippi valley against other wood basket manufacturers in the south and in Michigan, and against cardboard box and plastic basket manufacturers nationally.

Strategic and Operational Objectives

In 1988, Lawrence Box and Basket acquired a custom-manufactured basket-making machine. The machine is a modernized version of a similar machine operating at a basket manufacturing firm in Kentucky. The manufacturer of the original machine ceased production in the 1950s.

The company decided to purchase the basket making machine because of customer demand for peck, half-peck, quarter-peck and eighth-peck baskets. Existing methods and equipment enabled them to manufacture half-bushel baskets that were adjusted to serve as peck-sized containers. In addition, the company sought to speed production and improve the quality of its baskets.

Possible Company Performance Outcome Measures

The company measured performance improvement along several variables: set-up time, scrap, lower inventory (because of the shortened production times), and increased output.

Need for Retraining and Training Objectives

The basket-making machine was entirely new to Lawrence Box and Basket and incorporated technologies that the original machine in Kentucky did not use. Consequently, no one at the company was qualified to operate it. Since the machine was built by a local, self-employed machinist, vendor training was not included in its purchase price. Prior to making a grant, the Prairie State 2000 Authority assisted Lawrence Box and Basket in establishing specific duties for all employees and in designing the job training plan.

The mechanic was expected to perform the following tasks upon the completion of training:

1. Perform all duties of the operator.
2. Read air, electronic and mechanical schematics.
3. Change forms and make major adjustments to enable the machine to make six different sizes of baskets.

4. Replace and repair air cylinder parts, stapler parts, form advance mechanism, and air valves.

5. Identify and order correct parts for all systems and staplers.

6. Arc weld, gas weld, braze, and cut steel with a cutting torch.

7. Keep written records of machine servicing and hours of machine production.

8. Use the drill press and the lathe and identify the correct hand tools for work to be done.

The company's three machine operators were expected to perform the following tasks upon the completion of training:

1. Know all possible hazards that could be found around the machine before, during, and after operation.

2. Make minor adjustments to all systems, adjust air cylinder pressure, adjust the electronic control of the staplers for correct speed, and adjust the stapler feeder for the correct amount of wire for the different sizes of baskets.

3. Identify the correct wire and know the correct way to install wire on the basket machine. Be able to feed wire correctly into the stapler head without damaging the wire or wire feed mechanism and stapler head.

4. Inspect the material for defects for the final time before the basket is made. Make sure the web size is correct for the size of basket that is to be made.

5. Operate the machine efficiently.

Description of Retraining Program

Retraining was provided by the machinist who built the basket-making machine. The maintenance mechanic at Lawrence Box and Basket received four weeks of training on the company's premises. Three basket machine operators each received approximately one week of training, which consisted of on-site instruction on the basket-making machine.

Need for State Assistance

Although sales had grown significantly, Lawrence Box and Basket was still operating at a loss. The Prairie State 2000 Authority assisted the company in the training design and task specifications. The grant and technical assistance from the Authority made it possible for the company to provide formal training to the mechanic and machine operators.

Performance Outcomes

Lawrence Box and Basket reported that scrap had dropped significantly from 1 percent of veneer stock to less that 0.1 percent. Set-up time on the new machine was one-half hour, down from half a day on the most comparable machine. The new machine produced three baskets per minute. The half-bushel basket machine that was used to make one-peck baskets produced at a rate of 2.5 baskets per minute. The quality of the baskets was significantly better with the new machine and product diversity was broader.

Training Outcomes

The trainer did not certify whether the workers could perform the tasks for which they were trained. However, the workers have routinely operated the machine following training.

Observations

Lawrence Box and Basket reported that the Prairie State 2000 Authority was the first state agency that had responded to its request for assistance of any sort. As a consequence of the agency's help, the company was able to provide training to a core group of operators and establish a formal maintenance and repair program for the machine.

■ TRAINING GRANT RECIPIENT:

Lyphomed, Inc.
Melrose Park, Illinois

Training Grant

Lyphomed, Inc. received a $41,278 training grant from the Prairie State 2000 Authority in December 1988. The training grant was used to provide training in Good Manufacturing Practices (GMP). The state grant covered the costs of the training provided by an outside contractor and by Lyphomed personnel previously trained as trainers. The grant also covered 25 percent of the costs of designing the curriculum and developing training materials.

Focus of Case Study

The case study addressed the use of the training funds in improving quality control procedures in a manufacturing facility.

Overview of Company or Industry

Lyphomed, Inc. is a leading producer and supplier of critical care injectable pharmaceuticals. These products include nutritional support products and a large variety of therapeutic pharmaceuticals. The company's products are used primarily in the treatment of infections, cardiovascular disorders, cancer, and other serious diseases. In addition to the proprietary products it has developed, Lyphomed offers an extensive line of multisource (generic) pharmaceuticals.

Pharmaceutical manufacturers are subject to periodic inspection and testing of their products by the Food and Drug Administration (FDA). The FDA has established Good Manufacturing Practices regulations governing the production of drugs, including specifications as to quality and laboratory controls, facilities and equipment, production and manufacturing processes, packaging, distribution and record keeping. The FDA has extensive enforcement power, including the power to recall, seize, and prohibit the sale of noncomplying products and to halt operations of manufacturers that are out of compliance.

In mid-1987, following a routine inspection by the FDA of the manufacturing plant in Melrose Park, Illinois, Lyphomed was cited for 44 regulatory and manufacturing deficiencies and certain sanctions were imposed. In 1988, the company signed a voluntary agreement with the FDA outlining steps that Lyphomed would have to take to enhance its quality control program. An inspection in the fall found the company in substantial compliance with Good Manufacturing Practices and sanctions finally were removed. However, a fall-off in sales during 1988 stemming from the FDA sanctions resulted in a layoff of 80 workers out of 350.

During 1988 the FDA inspected Lyphomed's manufacturing facility in Orlando, Florida. More serious deficiencies were found and sanctions were applied. Subsequently, Lyphomed closed the facility and put it up for sale.

Until 1989, Lyphomed was a publicly held company. It was purchased then by Fujisawa, a company that had held a 30 percent stake since 1985. The deal is expected to be consummated in 1990.

Competitive Problems Faced by the Company or Industry

In March 1989, Lyphomed reported that it operates in a very competitive environment against a number of substantially larger companies that develop, manufacture and market parenteral and other pharmaceuticals. It considered itself a significant supplier of specialty, critical-care parenteral pharmaceuticals.

The principal competitive factors in the pharmaceuticals market, according to Lyphomed, are product development, price, product quality and innovation, trade name differentiation, customer service (including sufficient inventories for timely delivery), and breadth of product line. Lyphomed believes that quality of products and price are most important in the hospital and home care portion of the pharmaceutical market, and price is the most significant factor in the distributor portion.

The FDA's actions against Lyphomed called the company's quality assurance into question. This put the company at a significant competitive disadvantage to other pharmaceutical companies that exploited this issue with Lyphomed customers.

Strategic and Operational Objectives

Overall, Lyphomed's major strategies were to develop innovative products and cost effective dosage forms, packages, and formulations designed to meet the needs of pharmacists in the current reimbursement environment. It also sought to continue to take advantage of brand-name therapeutic pharmaceuticals as they come off patent.

In 1988, Lyphomed reported in its annual report that resolution of the FDA's quality issues were a top management priority. The adoption and implementation of Good Manufacturing Practices were a key aspect of the company's strategy to achieve acceptable quality levels. Specifically, the company was determined to complete the next FDA audit successfully.

Possible Company Performance Outcome Measures

Two key indicators of improvements in quality are the rate of complaints about products and the microbial counts in sterile processing rooms.

Need for Retraining and Training Objectives

Federal statutes and FDA regulations since 1976 require that pharmaceutical companies follow Good Manufacturing Practices in the production of therapeutic drugs. Interpretation of these regulations as manifested in the standard operating procedures of a pharmaceutical company varies company. However, the FDA reviews the efficacy of these procedures and audits company personnel in their performance. Consequently, it is essential that all personnel be able to perform their jobs in accordance with these standards and practices. Training is instrumental in conveying these standards and practices.

Training Program

The grant from the Prairie State 2000 Authority subsidized the development of the training curriculum, training materials, and the time spent by an outside contractor and certain Lyphomed employees in training the production-related workforce in Good Manufacturing Practices. The course curriculum was developed by an outside contractor that developed all course material in consultation with Lyphomed staff, including text books and an introductory instructional videotape.

Training occurred in two stages. First, 37 exempt personnel received training for trainers. Then, each of the company's production employees received a one-hour session. Each worker completing the training was expected to do the following.

- Explain what current Good Manufacturing Practices are.
- Define the important terms and concepts of current Good Manufacturing Practices.
- Explain the relationship between current Good Manufacturing Practices and Standard Operating Procedures.
- Identify some possible consequences of failure to follow current Good Manufacturing Practices.
- Understand the importance of current Good Manufacturing Practices.

Specific training for aseptic practices was provided to personnel whose jobs required it.

Need for State Assistance

Although Lyphomed was obligated to train its workers in Good Manufacturing Practices, it claimed that it lacked the resources to develop and implement a comprehensive training package within the time that was optimal.

Performance Outcomes

Lyphomed reported that complaints about its products for 1989 were half what they had been in 1988. In addition, it reported that microbial counts had decreased. At the time of the case study, the FDA had not reaudited the Melrose Park facility. Therefore, it is not possible to know whether the current Good Manufacturing Practices will meet FDA approval.

Training Outcomes

Inasmuch as training objectives were stated in behavioral terms, it would have been possible to assess the ability of each worker to articulate the principles of current Good Manufacturing Practices. At the conclusion of each training session, workers in fact were required to complete a written exercise designed to assess their understanding of current Good Manufacturing Practices.

Observations

Lyphomed's efforts to train its workers in current Good Manufacturing Practices have had the added effect of reassuring Lyphomed customers of the quality of its products.

■ TRAINING GRANT RECIPIENT:
Manth-Brownell, Inc.
Kirkville, New York

Training Grant

The Economic Development Skills Training Program awarded $74,780 for training at Manth-Brownell. Manth-Brownell incurred an additional $129,176 in training expenses. The training grant included statistical process control (SPC) training for all employees; problem-solving and leadership training for 20 group leaders, foremen, supervisors and selected salaried individuals; blueprint reading; geometric tolerancing; metrology; basic machining; and computer skills. Approximately $46,000 of state funds were used to pay the fees of trainers. Nearly $10,000 was paid to cover one-half the wages of new hires receiving the training. The remaining funds were used for training supplies and materials. Nearly $106,000 were costs in wages for release time incurred by the company. Training commenced early in 1989 and had not been completed at the time of the case study.

Focus of Case Study

The main thrust of the training program was in statistical process control (SPC). The other training was designed to support the implementation of a total quality control system at Manth-Brownell. The case study focused on the SPC training.

Overview of Company or Industry

Manth-Brownell is a family-owned manufacturer of turned parts. Founded in 1951, the company has grown from a one-person operation to a business employing approximately 175 workers in November 1989. Manth-Brownell's growth resulted from strategic decisions to pursue specific markets. About five years ago, the company, employing approximately 75 people, made a successful effort to expand its sales base beyond the two to three customers that it was then serving. Within two years, the company had grown to 100 employees and was sufficiently large to support its own engineering staff. Manth-Brownell's subsequent growth has come as a consequence of efforts to diversify its customer base and its growing reputation for being attentive to customer needs.

The screw machine and turned parts industry produces a broad range of finished goods used in a wide variety of highly diverse end-use markets. Products requiring high tolerances, excellent surface finishes, and complex shapes may be made in high volumes by metal-turning companies.

Manth-Brownell is organized into five product areas: the Car Department manufactures parts for the automotive industry as well as other, similar customers. The CTV Department manufactures parts for the cable television industry. The Gun Department makes parts for the gun industry. The Long-Run and Short-Run departments are metal-turning job shops distinguished by the length of their production runs. The long-run shop produces runs of 100,000 parts. The short-run shop produces runs of 500 to 3,000 parts.

Competitive Problems Faced by the Company or Industry

During the summer of 1988, Manth-Brownell's senior management, using a study prepared for the National Screw Machine Product Association, determined that its optimal strategic path was as a customer-oriented, reliable producer of high-quality turned parts. The study, "1984 Market Position Analysis of the Screw Machine and Turned Parts Industry: Projections through 1988," noted that end users of turned parts were increasing their demands for consistently high-quality parts priced in accord with actual specifications. The study also noted that the greatest window of opportunity for future growth was among businesses that had captured machine products operations comprising not more than 35 percent of their operations. The study concluded that many of these businesses would not find it economical to continue making their own turned metal parts. For example, the automotive industry was expected to turn to outside vendors as the source of virtually all its turned metal parts.

In order to compete effectively in these new markets, and particularly in the automotive industry, manufacturers of screw machine products would be required to produce parts that met strict quality standards and technical specifications at a low price. Customers were expected to review these factors closely as other technologies (e.g., cold formed parts, plastics, die casting, and powder metallurgy) began to enter the market previously held exclusively by manufacturers of screw machine products. Parts manufacturers would have to provide engineering assistance because major manufacturers of final products were increasingly expected to involve component suppliers in the design of new components. Finally, parts manufacturers were expected to have self-monitored quality control programs, such as Statistical Process Control, because responsibilities for quality would shift from customers to suppliers as customers implemented just-in-time delivery schedules.

Strategic and Operational Objectives

Manth-Brownell's operations were reorganized by management and production employees so that each department focused on a single part, customer or product type. Previously, each department handled a stage in the manufacture of all parts produced at Manth-Brownell. The change was expected to increase the company's focus on the customer and thereby reduce quality problems, improve product deliveries, and lower prices. The other goals of the reorganization were to develop the expertise of Manth-Brownell employees, improve teamwork, increase the sharing of technological expertise, and improve the commitment and loyalty of employees.

Possible Company Performance Outcome Measures

Manth-Brownell officials expected to see improvements in four indices. Management expected declines in the percentage of parts being reworked against inventory and the number of returns as a percentage of sales--both indicators of an improvement in quality. Improved customer relations and market position were expected to be detected in the quarterly percentage increase in sales over sales of the same quarter in the prior year and in the quarterly average of backlog orders.

Need for Retraining and Training Objectives

The core element of Manth-Brownell's strategy was to improve and document the quality of its product for its customers. In fact, the decision to reorganize production operations was made after company executives concluded that the existing procedure of manufacturing in stages tended to isolate responsibility for quality in the quality inspection teams. In order for the reorganization to work and for the quality improvement strategy to succeed, it was essential that Manth-Brownell make a wholesale change in its corporate culture by training every employee in statistical process control. The goal of the training was to teach all production-related personnel to use statistical process control techniques to identify quality problems and to find the source of these problems. As their final assignment, workers were asked to use SPC techniques to address a real-work problem of their own choice.

In addition, the reorganization required that workers function in teams that would establish their own work patterns and solve production and quality problems as they occur. This constituted a significant change in the leadership style of foremen and other production managers from a somewhat autocratic style to a participatory one. Therefore, Manth-Brownell management determined that their middle managers and production team leaders would require training in team leadership.

Finally, Manth-Brownell and its training providers determined that many of the workers lacked some of the pre-requisite skills to function effectively in a quality assurance program. Consequently, management decided to offer courses in blueprint reading, geometric tolerancing, basic machining, and computer skills.

Although no specific skill expectations were set for the training, minimum skill requirements could have been established if the proposed evaluation system had been in place. For instance, the project required of every worker in SPC training could have been the basis for the instructor to certify that the worker was able to work in the Manth-Brownell quality assurance environment. Similarly, instructor-supervised exercises in the leadership training and practical, problem-solving exercises in any of the cognitive training classes could also have established whether the workers had absorbed the training and were able to apply it to real-life situations.

Training Program

The retraining program was conducted under the auspices of the State University of New York, College of Agriculture and Technology, at Morrisville, New York. Although Manth-Brownell was not limited to the Morrisville faculty, they provided training.

All employees received 24 hours of statistical process control training in six sessions of four hours. The training covered the following topics: data collection, histograms, normal curve, variable control charts, attribute control charts, scatter diagrams, process capability study, capability index, gage (repeatability and reproducibility), and pre-control charts. Training occurred in groups of 12 individuals from the following areas: Brown & Sharp machine, Davenport machine, Large Multiple Spindle machine, Small Multiple Spindle machine, CNC, Second Operation, NC Secondary, and Production Support (i.e., tool engineering, maintenance, shipping, office, and management). All employees received their normal base salary rate for the time spent in the training sessions.

In addition, all employees received 12 hours of training in basic problem solving methods. The training occurred in the same groups as in the statistical process control training.

Problem-solving leadership training was provided to 20 group leaders, foremen, supervisors and selected salaried individuals. Each received 32 hours of training in eight sessions running four hours each. There were two groups of 10 individuals. Topics covered included group dynamics, training adults, problem- solving methods, planning and organization, motivation, communications, effective meetings, coaching and counseling, and managing change. All employees received their normal base salary rate for the time spent in the training sessions.

Finally, the following courses were offered in classes of ten to twelve employees each: blueprint reading, 6 courses, 8 hours each; geometric tolerancing, 3 courses, 24 hours each; metrology, 6 courses, 24 hours each; basic machining, 4 courses, 18 hours each; computer skills, 6 courses, 4 hours each.

Need for State Assistance

Company officials stated that the assistance from New York shortened the period that Manth-Brownell workers would be engaged in training. This speeded the reorganization.

Possible Project Monitoring Design

The New York Economic Development Skills Training Program asks that the training provider submit the following monthly reports: State of New York Standard Voucher for reimbursement, Cash Request Form, and Statement of Funds Expended. As back-up, the provider must submit detailed information on personal services costs, on-the-job training costs, and other costs. The provider also reports quarterly on program activity, the characteristics of participants in upgrade/retraining programs, the characteristics of participants in new-hire programs, and accrued expenditures. The provider also submits quarterly a one-page narrative of progress to date, including a discussion on any unique aspects of the program and on barriers to implementation. The reports on program activity focus on cumulative enrollments, terminations, upgrade and placement totals and current enrollments. However, we believe that the provider should submit quarterly information on the cumulative number of workers completing the training who have achieved minimum skills requirements.

Performance Outcomes

Manth-Brownell reported that rework as a percentage of inventory declined by over 80 percent between June 1988 (just prior to the company reorganization) and September 1989. Between December 1988 and October 1989, returns as a percentage of sales declined by over 70 percent. In addition, sales increases over the previous year's quarter were 25 percent for the second quarter of 1989, 18 percent for the third quarter, and 32 percent for the fourth quarter. Finally, the average number of orders that were past due declined 50 percent between the third quarter of 1988 and the fourth quarter of 1989.

Training Outcomes

No specific training outcomes were measured.

Compensation System and Trainee Earnings

New York is not a wage-reporting state. Data on the wages and earnings of workers receiving training were not available. Manth-Brownell workers are compensated with wage ranges that are based on their job classifications. Increases within the ranges are based on time of service and merit. Workers are reviewed twice during the year, at which time their wages may be increased or they may receive a promotion.

Manth-Brownell workers also participate in a gain-sharing program. Company profits are calculated four times each year for the purposes of this program. Twenty percent of the profits then are returned to the workers.

Observations

The Manth-Brownell case illustrates that the decision to implement a quality assurance program may have far-reaching effects on the organization of the company and the manufacturing process. Once they concluded that the company needed to use statistical process control, Manth-Brownell executives deduced that structural changes were required to support it. They then rearranged the entire shop floor, cross-trained all production personnel, and acquired new washing equipment. By the end, workers had selected their new working units, designed the arrangement of the processing equipment in the working cell, and had accepted the responsibility of working directly with the customer receiving the parts that they produced. The training was instrumental in the success of this effort in that it was an effective means of enculturating the entire workforce, including management, to Manth-Brownell's new customer service and quality assurance policies.

■ TRAINING GRANT RECIPIENT:
Metcraft, Inc.
Grandview, Mo.

Training Grant

Metcraft, Inc. received a $7,450 training grant from the Missouri Customized Training Program for retraining employees in Computer-Aided Design and Drafting (CAD) and Computer-Integrated Manufacturing (CIM) theories and production methods. Nine company employees received training between April 1 and July 30, 1987. The training grant was developed and administered by Metropolitan Community College of Kansas City. The grant covered the direct instructional costs of the outside trainer at $400 per day for 10 days and $200 per session for 10 sessions for in-house training. The remaining grant funds were used for instructional supplies and the administrative expenses of the community college.

Focus of Case Study

One major part of the project was the retraining of engineering staff in the use of CAD software to improve efficiency in the engineering operations of the company. This case study focused on the CAD training for engineering staff and the importance of efficiency improvements in the engineering unit for company performance objectives.

Overview of Company or Industry

Metcraft, Inc. manufactures commercial stainless steel plumbing fixtures, food service equipment and drop-in sinks. Their product lines primarily are designed for prisons, hospitals, schools, recreational facilities, restaurants, and other commercial/industrial installations. All of Metcraft's product lines are produced at its single Grandview facility with 65 employees. It is a unionized facility with sheet metal workers represented by the Sheet Metal Workers # 2. They have had only one grievance in 21 years.

Metcraft, Inc. is owned by EMCO Limited, a Canadian-based manufacturing and distribution corporation consisting of 35 separate companies organized under five operating groups with annual sales of over $1.2 billion. Masco Corporation of Taylor, Michigan is the major shareholder. EMCO, Limited is a highly decentralized corporation with all 35 companies independently managed and operated.

Metcraft, Inc. has been in business since 1969. Between 1969 and 1981, the company specialized in customized food service equipment. In 1981, EMCO, Inc. transferred the production of security fixtures to the Grandview facility from a Canadian plant. In 1987, the production of drop-in sinks was transferred to Metcraft. Currently, Metcraft, Inc. has two major product lines--plumbing fixtures for penal institutions and tables, enclosed bases, sinks and cafeteria counters for the food service industry. This food service equipment usually is custom designed to building specifications. In 1989, a patented/UL listed pots and pans scrubbing machine called "Power Soak" was added.

Competitive Problems Faced by the Company or Industry

Metcraft, Inc. faces stiff competition from other companies on price, quality, and the delivery time in their customized sheet metal markets and product lines. In order to remain competitive as a custom fabricator, Metcraft developed a modernization plan to improve productivity and quality and enhance the strong reputation of the company as a responsive and on-time deliverer of customized products. Another goal was increasing sales capacity at the facility from $4 to $12 million. This plan included the introduction of CAD/CAM and CIM. The first stage of the plan was a $400,000 equipment purchase in 1986-87 including a CNC Turret press and CAD/CAM equipment.

Strategic and Operational Objectives:

One part of the competitive strategy of Metcraft was to enhance its strong reputation as a highly flexible custom fabricator that could make adjustments and corrections of customer approved product designs and accept and meet very short product delivery schedules. In addition, Metcraft wanted to enhance its capability to work with customers in designing original products for specific commercial, institutional or industrial applications. In general, Metcraft wanted to maintain clear differentiation from its competitors in custom manufacturing and responsive delivery.

In order to accomplish this objective, Metcraft decided to introduce computer-aided design and drafting into the engineering department. This new technology was intended to enhance the capability of engineering staff to standardize certain products and product components and improve turn-around time on making corrections to customer approved designs. In their overall restructuring plan, Metcraft targeted a 50 percent decrease in the engineering time required in preparing a customer order or an original product drawing for manufacturing. The company wanted the capability to revise customer approved product designs in hours instead of days.

Possible Company Performance Outcome Measures

Two possible performance measures would have been applicable for the project in defining and measuring engineering efficiency:

- **Engineering Cycle Time:** the average number of days required to process an original product drawing for manufacturing.

- **Engineering Staff Costs:** the average labor costs in processing an original product drawing.

Need for Retraining and Skills Training Objectives

Most engineering staff at Metcraft, Inc. had only limited exposure to computer-aided design and drafting. This required engineering staff to receive introductory training. Other company employees had more exposure to CAD but required additional instruction on advanced capabilities of CAD and how it could be used in product design and integration into CAD/CAM.

Description of Training Program

Metcraft, Inc. worked with Metropolitan Community College to develop a training program for engineering personnel. The CAD training was provided by a software vendor from the Kansas City area with follow-up support provided by the vendor and company personnel. The training program involved 10 sessions covering specific features of CAD software and engineering applications. Company staff provided additional training and follow-up instructional support as needed.

Need for State Assistance

Although Metcraft, Inc. was able secure funds from its parent corporation to make major capital investments in equipment and machinery, the company did not have additional funds to train engineering and manufacturing staff. In particular, Metcraft did not have the funds to purchase outside training services. Like most small companies, Metcraft also did not have an internal training capacity. The state assistance provided the necessary resources for company employees to receive formal outside instruction so that they could in turn provide internal training to other company employees.

Performance Outcomes

Metcraft was successful in achieving its major performance objective in the CAD training for engineering staff. Approximately one year after receiving the CAD training, engineering staff reported that they had substantially reduced the amount of engineering staff time required to correct or process a customer design. Metcraft estimates that a standard processing cycle that used to take about 5-6 working days has been reduced to 2-3 days. The company was successful in reaching its performance target of a 50 percent reduction in engineering cycle time as defined in the proposed measures.

Training Outcomes

Metcraft, Inc. did not utilize a formal competency-based instructional system with post-testing. However, it is clear that they had clear training objectives that could have been easily written into a formal curriculum with post-testing of functional skills. The engineering staff that received training indicated that they now have the necessary skills to utilize CAD technology in the engineering unit. They also felt confident that their new skills would be very helpful in finding other jobs within the Kansas City area if they became unemployed.

Compensation System and Trainee Earnings

The engineering staff receiving training under the state grant were salaried employees. Metcraft installed a profit sharing program, a 401K savings system with company matching funds, a strategic plan bonus incentive at year end along with their annual review. Without the growth, none of this would have been possible.

Observations

This case study provides a good illustration of how state training funds can be used effectively with small businesses in improving competitive performance. It also illustrates how training grants can be used to establish an internal training capacity within small businesses by "train-the-trainer" strategies; that is, training employees to be future trainers in the implementation of advanced technology into the workplace. When the training began Metcraft employed 59 area residents. The use of CAD/CAM and CIM technologies was one key ingredient to the company's growth to over 100 employees.

■ TRAINING GRANT RECIPIENT:
National Tooling and Machining Association, Los Angeles Chapter
Los Angeles, California

Training Grant

The Los Angeles chapter of the National Tooling and Machining Association (NTMA) received a $473,200 training grant from the Employment Training Panel for retraining 182 machinists and machine operators in computerized numerical control (CNC) programming and machine operation. The training grant was for a 13-week training program conducted between February 1, 1987, and February 28, 1988. The training grant was used for the direct instructional costs of 28 hours of classroom training and 89 hours of laboratory training at a centralized training center operated by the Los Angeles chapter.

Focus of Case Study

The training grant served 87 companies in the Los Angeles and Orange County areas. The case study was based on interviews with center staff and five companies participating in the training program.

Overview of Company or Industry

The Los Angeles chapter of the National Tooling and Machining Association (NTMA) was established in 1974 as an independent chapter when its predecessor, the Southern California Tool & Die Association (SCTDA), established in 1951, was divided into two chapters. The Los Angeles chapter is the largest and oldest NTMA chapter with approximately 200 members in a service area spanning approximately 2,400 square miles in Los Angeles and Orange Counties.

The Los Angeles chapter operates a centrally located training center serving small and medium-sized manufacturing companies in its Los Angeles and Orange County service area. The NTMA training center in Los Angeles provides classroom instruction as well as hands-on training with 71 pieces of equipment including a CAD/CAM system, six CNC lathes, and six CNC mills. It also has closed circuit television and a video tape library and text materials developed by the NTMA. The center administers an apprenticeship program that has an average enrollment of 350 apprentices. Since 1968, the Los Angeles chapter has been active in publicly funded pre-employment training programs for both member and nonmember companies. The training center currently trains approximately 350 people annually for placement within the industry.

Eighty-seven companies participated in the CNC retraining program funded by the Employment Training Panel. Five companies were visited as part of the case study.

California Jig Grinding, located in Pico Rivera, is a small company of 50 employees located in three facilities. The company specializes in the use of CNC technology in jig grinding and boring to close tolerances. It has a large and diversified customer base serving over 2,500 firms both inside and outside the United States.

LeFiell Manufacturing Company, located in Sante Fe Springs, specializes in the engineering and manufacturing of sophisticated tubular parts and assemblies for the aerospace industry. Its major product lines include missile cases, high temperature tubing and components, gas turbine engine shafts, control rods, struts and braces, and liquid thrust chamber coolant tubes.

NC Dynamics, located in Paramount, is a small customized manufacturer specializing in numerical control (NC) and computerized numerical control (CNC) applications in the production of precision aerospace parts. It employs approximately 20 people. The company's primary products are door frames for the aerospace industry.

Peacock Engineering, owned by Nortek, Inc., is a small manufacturer of precision aerospace parts. It employs about 120 people and is located in Norwalk. The company's major product lines include landing gears, hydraulic and mechanical actuators, valves, cylinders, engine mounts, rotor shafts, and other complex assemblies for the aerospace industry.

Wesval, Inc. is a small manufacturer with 32 employees and is located in Anaheim. The company specializes in hydraulic assemblies and provides both developmental and production services. Its major customer base is the defense and aerospace industries to which it supplies hydraulic valves.

Competitive Problems Faced by the Company or Industry

The Los Angeles chapter of the National Tooling and Manufacturing Association serves a population of small and medium-sized tooling and machining companies that provide precision manufacturing services to large companies mostly in the defense and aerospace industries. As in most manufacturing industries, computerized numerical control (CNC) technology has become a core aspect of the defense and aerospace industries. The technology represents a major part of larger efforts to move toward computer- integrated manufacturing. Increasingly, small and medium-sized contractors must convert their operations to CNC technology in order to meet the machining capabilities and quality standards required by large defense and aerospace companies as well as other large manufacturers. CNC technology can produce some components that cannot be produced by conventional machining technology. In addition, CNC technology provides the basis for improving quality standards because the technology can consistently manufacture products at close tolerances that cannot be produced by manual machining methods.

Because of strong cost competition from domestic and foreign companies, Los Angeles-based companies must make the most efficient use of CNC technology through adopting more efficient production processes and employing more highly skilled machinists and machine operators. This has placed strong pressure on small companies to purchase CNC equipment and retrain experienced workers so that the CNC machinery can be used effectively to meet the increased performance requirements in the industry.

Strategic and Operational Objectives

Small and medium-sized tooling and machining companies are introducing CNC and NC equipment into their operations in order to improve efficiency and quality and to be able to meet the machining requirements of major defense and aerospace contractors. In general, the five companies visited as part of the case study implemented CNC technology and sent machinists and machine operators into the retraining program in order to achieve specific operational objectives on the machining capabilities, quality standards (tolerance levels), and productivity (e.g, throughput, setup times) required to remain competitive in securing contracts with major manufacturing companies.

Possible Company Performance Outcome Measures

The companies sending employees for retraining at the training center were attempting to increase the use of CNC machines in their operations. Most companies sent experienced machinists or machine operators who volunteered for the retraining. The major objective of the companies was gradually to convert all conventional machinists and machine operators into fully trained CNC and NC machinists and machine operators.

In some companies, the retrained workers represented as much as 65 percent of all machinists and machine operators. In other companies, the retrained workers represented about 20 to 30 percent. In companies that retrained most of their machinists and machine operators in specific work units or departments, the retraining was expected to result in improvements in one or more of the following performance areas.

Quality Failure Costs.

1. Labor costs in reworking products to meet client specifications.
2. Material costs of products scrapped because of variance with quality standards.

Labor Productivity

1. Value or amount of products produced per direct labor hour.

2. Average changeover or setup time for production runs.

CNC Utilization

1. Products produced on NC/CNC machinery as a percentage of planned capacity.

2. Percentage of total sales on products required CNC machining.

However, for companies that retrained a small percentage of their machinists and machine operators, other performance indicators may be more appropriate. In these cases, performance improvements should be captured by measuring the increase in the use of CNC equipment in the company. In these cases, performance improvement could be measured by one of the following indicators.

CNC Machine Utilization:

Percentage of time retrained workers spend on NC/CNC equipment.

Need for Retraining and Training Objectives

The companies that participated in the training program were converting most of their machining operations from manual to NC or CNC equipment. This retraining was necessary for companies fully to use the CNC equipment they already had in place. These companies had machinists and machine operators with extensive experience in basic machining and manual equipment, but they did not have any training or experience in CNC operations. The major training objective was to provide experienced machinists and machine operators with basic introductory training to CNC as well as hands-on experience. The companies would then provide more specific training in their own shops.

The retraining program was designed to provide machinists and machine operators with the ability to perform setups of moderate complexity on CNC milling machines and CNC lathes. It was also designed so that trainees could operate the EZ-CAM computer system to generate programs.

Training Program

The NTMA training center in Los Angeles developed a 13-week training program for 32 machinists and 150 machine operators. This program included 117 hours of instruction including 28 hours of classroom and 89 hours of laboratory training at the training center. The program began with machining fundamentals, shop math, and blueprint reading. This was followed by instruction in NC and CNC fundamentals and manual and computer programming. These two parts of the training program involved about 22 hours of classroom training and 19 hours of laboratory training. The training program then addressed machine setup and operation, manual and computer control of machine operations, program editing and up- and downloading, and tool compensation. This was followed by instruction on the EZ-CAM computer and special projects in which students demonstrated their skills on the computer system and CNC mills and lathes.

The program consisted of four and one-half hour class sessions twice a week. Each class session was divided into classroom lecture, machine laboratory, and computer programming. The program utilized a textbook on concepts and programming for computer numerical control and supplemental materials developed by the training center staff. All instructors at the training center had recent industry experience and had post-secondary teaching credentials from the state of California.

Need for State Assistance

Small and medium-sized businesses in the tooling and machining industry generally do not have the internal resources to fully train their employees. Most companies have the time and resources to demonstrate specific CNC applications or work procedures after workers have received basic training. However, they cannot provide the basic training in math and blueprint reading or general skills training in computer programming, machine setup and operation, and maintenance.

In addition, these businesses perceive a high potential cost for training with an uncertain return on investment. Small employers constantly face the risk of losing trained employees to other companies, especially larger employers who can pay higher wages and benefits. Many times, small employers become the training ground for large employers. This risk is especially high in CNC training for experienced machinists and machine operators in the Los Angeles area. Some companies reported that the demand for skilled machinists is so strong that they regularly attempt to recruit workers from outside of the United States.

The state assistance was important in providing companies with a centralized training center that provides basic skills training and introductory CNC training with hands-on experience. Without the state assistance, companies reported that they could not have provided the necessary scope and depth of basic training. They probably would have sent one machinist for training by an equipment vendor or another outside training provider and would have had that machinist provide some type of one-on-one instruction to other workers at their facilities. This type of training would not have allowed them to make full utilization of their CNC equipment.

Performance Outcomes

The five companies that were visited all indicated that they were able to increase their use of CNC equipment because of the retraining program. No specific performance improvement information was available at the time of the case study. However, one company reported a significant reduction in rework time the year after training was completed.

Training Outcomes

The CNC training program involved a 24-question pre-test in math and a 60-question test in mechanical aptitude. The pre-testing was conducted to identify skill problems that could be addressed through special tutoring and individualized instruction.

The training program did not have formal post-testing. However, it was organized on the basis of clearly defined training objectives with class exercises and self-evaluation tests designed to give the trainee and instructor continual information on the achievement of training objectives. In addition, the program involved special projects which were designed to integrate the skills learned in the program. These projects were graded and presented at the end of the program.

Companies reported that the training center provided their employees with a strong background in CNC that could be useful to workers in any type of manufacturing company. Some companies noticed that retrained workers were better able to handle routine setups and engage in problem-solving on more complex machine operations. This training clearly provided workers with marketable skills within the Los Angeles area. In addition, some companies reported that retrained workers received raises and promotions after retraining. One company reported that all trainees were promoted after the training program with some entering management ranks.

Observations

This case provides an excellent illustration of the potential role of industry associations in providing centralized training services to small employers in precision manufacturing industries. In these types of industries, a local industry association provides a direct source of credibiilty and accountability to small employers, especially small employers who have had little if any contact with government programs. The NTMA training center in Los Angeles provided a critical training service to small employers that was not currently available from public educational institutions and could not have been provided by the employers themselves. The centralized training center was critical in insuring the participation of small employers as well as their commintment to retraining their employees in CNC skills.

■ TRAINING GRANT RECIPIENT:

New United Motors Manufacturing, Inc.
Fremont, California

Training Grant

The New United Motors Manufacturing Company (NUMMI) in cooperation with the United Automobile Workers Labor and Training Corporation (UAW-LETC) received a two-year $1,300,000 grant from the Employment Training Panel to upgrade and cross-train 152 employees in the skilled trades as general maintenance workers. NUMMI later received a second training grant of $4,979,880 from the Employment Training Panel to retrain 1,620 production employees in standardized work, quality control, team-building, safety, and problem-solving techniques.

Focus of Case Study

This case study focused on the role of state funds in the training of production workers during a model changeover period in order to improving productivity and quality as the new model was launched. This case study also addressed the role of training funds in cross-training skilled trades workers and the importance of cross-training in improving the effectiveness and efficiency of maintenance units.

Overview of Company or Industry

New United Motors Manufacturing, Inc. (NUMMI) is a joint venture between General Motors and Toyota that was created in 1983 to build small automobiles at the refurbished General Motors plant in Fremont. The joint venture first produced the Nova. It now produces various GEO small car models with a new Toyota truck line scheduled for next year. The plant employs approximately 2,300 production and skilled trades workers represented by the United Automobile Workers, Region 6, Local 2244.

Competitive Problems Faced by the Company or Industry

Growing productivity and increased foreign competition have resulted in a manufacturing capacity in the auto industry that exceeds future sales projections. In response, American and foreign auto companies have begun to reduce and consolidate their manufacturing capacity. They have begun to phase out or modernize older assembly plants and open up new, highly automated facilities with advanced technologies and new production methods. This consolidation and reduction in manufacturing capacity is likely to continue well into the 1990s.

The future survival of automotive assembly centers such as NUMMI's Fremont facility is dependent on their ability to remain competitive in productivity, cost, and quality. Failure to remain competitive could result in reduced customer demand, the consolidation of current model production or its transfer to other General Motors or Toyota plants, or the selection of competing facilities for new model production.

Strategic and Operational Objectives

NUMMI strives to maintain the highest productivity and quality standards in the industry through a commitment to Japanese production methods and teamwork principles within a highly automated assembly environment. Under the team concept, all production employees including team members, team leaders, and group leaders must have the skills and abilities to analyze and redesign the jobs within their team. They also must be cross-trained to have the skills to perform all jobs within the team and demonstrate the ability to train other team members and assume leadership in group problem-solving activities.

Part of the NUMMI philosophy is a strong commitment to employee involvement and job security. Since its opening in 1984, NUMMI has remained committed to a no-layoff policy established with the UAW under a collective bargaining agreement.

As part of the joint agreement between Toyota and General Motors, NUMMI agreed to give hiring priority to former GM workers who were laid off when the Fremont facility closed. When NUMMI opened in 1984, the company faced the problem of retraining former GM employees in new production methods and a new corporate culture emphasizing cooperative management-labor relationships. The company provided some initial training to group and team leaders and to some team members in Japanese production methods. Group and team leaders were given approximately one week of instruction in standardized work and the basic principles of Kaizen or continuous process improvement before implementing these new production methods in the launch of Nova production in 1985.

In 1988, General Motors reduced its order for Novas, thus reducing the Fremont facility to approximately 65 percent of full production. In addition, the Fremont facility was in the final year of production on the Nova and was scheduled to undergo a $200 million retooling for the new GEO Prism and Toyota Corolla. In most automotive plants, the combination of slumping sales and model retooling results in temporary lay-offs for most production workers. However, given the NUMMI-UAW no-layoff agreement, the company was faced with a decision on how best to use the idled production workers in preparation for the new model launch and the resumption of full production.

The company decided to use the slowdown period to provide advanced training to production workers in order to improve the efficiency of the new product launch and improve the productivity and quality levels of the facility under full production. One major goal was to shorten the product launch cycle for the GEO Prism and Toyota Corolla, that is, to shorten the time from the beginning of limited production of sellable cars to achievement of full production at planned productivity and quality levels. The major operational strategy was to build on the prior training given to team and group

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leaders and extend training to team members in ergonomics and safety, Kaizan, and quality control.

The competitiveness of NUMMI's Fremont facility is dependent in part on the ability of the company to maintain full production without major downtime due to breakdowns in sophisticated equipment and machinery. When NUMMI began operations, the maintenance unit was organized according to traditional distinctions among the skilled trades including journey-level electricians, machinists, millwrights, and pipefitters. However, NUMMI decided to improve the efficiency of the maintenance operations by cross-training people in the skilled trades to become general maintenance mechanics. The company also decided to introduce team concepts and advanced problem-solving techniques. This training was critical for maintaining the facility at full production in the face of increasing automation and the increased skills required of skilled trades workers in the maintenance operation.

Possible Company Performance Outcome Measures

The performance objectives of NUMMI at the Fremont facility could be measured through the productivity and quality audit reports used by the company and standard measures used by industry analysts:

- **Productivity**. Line speed or daily output per worker.
- **Quality**. Quality audit scores or the incidence of quality defects by department.

One major objective of the training project was to improve the product launch of the new GEO product lines. These performance goals could be measured as follows.

- **Launch Schedule.** The variance between plan and actual productivity and quality in the launch schedule of a new product line from initial launch to full production.

The performance objectives of the maintenance unit could be addressed through two standard indicators.

- Average downtime of production facility.
- Average response/repair time in conducting unscheduled repairs and returning the facility to full operation.

Need for Retraining and Training Objectives

The skilled trades workers hired by NUMMI between 1984 and 1987 were trained along traditional trade lines. They had work experience in either construction or manufacturing industries. The majority were journey-level electricians, machinists, millwrights, and pipefitters. Although these journey-level workers had substantial work experience, pre-employment tests revealed that many did not have sufficient basic and technical skills to work with the machinery and equipment at the NUMMI facility. In addition, NUMMI maintenance operations required the skills of general maintenance mechanics, which included the skills of more than one trade. These skills deficiencies required substantial retraining in order for the skilled trades workers to operate efficiently within NUMMI's maintenance operations.

Former production workers from the closed GM facility and other new hires coming into the NUMMI facility in 1984 and 1985 had no prior experience in Japanese manufacturing methods. They were given a brief introduction before the startup of production. In order to achieve further productivity and quality improvements through the full implementation of the team concept, these production workers required advanced training in Kaizan and related safety, standardized work, and quality control techniques.

Training Program

The skilled trades training program was developed and delivered by NUMMI instructors at its in-house training center located within the Fremont facility. The training center employed full-time and part-time instructors with separate classroom and laboratory facilities.

The training program was structured as a comprehensive program for general maintenance mechanics with skilled trades workers taking different components of the program depending on their different training needs. Training was delivered to six separate groups of skilled trades workers. The length of training programs varied between those with 100 hours of classroom training and 300 hours of structured, on-site training to those with 208 hours of classroom instruction and 832 hours of structured, on-site training. The largest group of 61 trainees received approximately 175 hours of classroom training and 525 hours of structured on-site training. All trainees received classroom instruction for two hours per day, four days per week and structured, on-site training for six hours per day, four days per week, and for eight hours on the remaining day. The length of the training program for each group of trainees ranged between 10 and 26 weeks.

The full training program included courses in blueprint reading and basic drafting; machine tool practices; industrial solid-state electronics; electricity and applications; welding; mechanical drive components; hydraulics; pneumatics; sheet metal and fabrications, plumbing and pipefitting; and heating, ventilation, air conditioning, and refrigeration.

The training program for production team members was provided in preparation for the launch of the 1989 model production in September 1988. The program was developed and delivered by NUMMI group and team leaders with the assistance of NUMMI training coordinators. NUMMI instructors worked with training committees and coordinators to develop instructional materials and course presentations.

Production team members were given 40 hours of classroom training covering three major components: Kaizen, quality, and ergonomics and safety. The 16 hours of Kaizen training included training in problem-solving techniques for continuous improvement in efficiency and safety. The quality training included 16 hours of training in quality control, causal analysis, and data collection methods. The ergonomics and safety training focused on safety issues in standardized work, personal safety, and facility safety practices. The classroom training was accompanied by 32 hours of laboratory training at actual team worksites in the facility during the model changeover process. During the process, trainees received new model orientation in new job sequences and processes and participated in group problem-solving activities to improve operations within teams. The laboratory training was followed by 200 hours of structured, on-site training, which emphasized building quality into standardized work procedures. The training was conducted during the gradual launch of the new production line.

Need for State Assistance

NUMMI committed significant company resources to maintaining production workers in full employment during a slowdown in Nova orders from General Motors and the 1988 model changeover. This commitment limited the amount of training funds that were available to the company to continue the retraining of production workers in Japanese manufacturing methods. The state training funds were critical in allowing NUMMI to reinvest in its workforce and insure a successful product launch and maintain the overall competitiveness of the Fremont facility relative to American and foreign competitors.

NUMMI did not have sufficient resources to provide the extensive training in basic and technical skills required for GM employees and other skilled trades workers to function efficiently as general maintenance mechanics within a highly automated plant environment. The state training funds were critical in providing a comprehensive training program that allowed classroom and laboratory training for a large number of apprentices and journey-level workers in the skilled trades.

Performance Outcomes

The company reported that the two training programs were successful in contributing to an efficient product launch for the 1989 models and maintaining full production with minimal unscheduled downtime. Additional performance information was not available at the time of the case study.

Training Outcomes

The skilled trades training program involved both pre- and post-testing. The post-testing included functional skill assessment through assigned projects and exercises. Program instructors expected trainees to demonstrate at least 80 percent proficiency within each major training module in order to receive a passing score. Successful completion resulted in the award of a formal journey-level certificate as a general maintenance mechanic from the state of California.

Although the production training did not involve formal post-testing, trainees were expected to demonstrate job proficiency and apply their new skills in team problem-solving during laboratory and structured, on-site training periods. No additional training outcome information was available at the time of the case study.

Trained workers in both the skilled trades and production training programs felt that the skills they learned would benefit them in finding employment outside NUMMI. The production workers felt that the NUMMI training provided them with a better reputation for management-worker interaction and productivity and quality. They also reported that the training gave them more self-confidence and knowledge, which would probably be reflected in job interviews. The skilled trades workers felt that the training would qualify them for similar maintenance jobs in other manufacturing facilities in the immediate area.

Observations

This case provides a useful illustration of how state training funds can be applied successfully to support an employment security policy at a major manufacturing facility. The training funds were instrumental in allowing the company to reinvest in its workforce while maintaining a firm commitment to its no-layoff policy. The case study also provides an excellent illustration of how companies can develop and deliver effective technical training programs within their own facilities for skilled trades workers.

■ TRAINING GRANT RECIPIENT:
Northwestern Steel and Wire Company
Sterling, IL

Training Grant

In September, 1986, Northwestern Steel and Wire Company received a $39,961 grant from the Prairie State 2000 Authority for the pilot project. The grant from the Prairie State 2000 Authority covered 50 percent of the direct instructional costs for training 50 supervisors between August, 1986 and August, 1987. The direct instructional costs included the instructor salaries for the on-site instructional coordinator and instructors at the area vocational center and the purchase of National Education Training Corporation (NETC) course materials and computer-assisted instructional materials.

This pilot grant was followed by a $76,240 grant from the Industrial Training Program, Illinois Department of Commerce and Community Affairs, to crosstrain 50 individuals between September, 1987 and June 30, 1988. This grant was used to cover 50 percent of the wages of trainees when they were in formal training activities. This grant was used to initiate the crosstraining of hourly employees in craft positions.

Focus of Case Study

This case study addresses the state funding provided by both state agencies in support of the implementation of the Multicraft Training Program at Northwestern Steel and Wire Company. This case study addresses training activities between September, 1986 and June, 1988.

Overview of Company or Industry

Northwestern Steel and Wire Company is an integrated producer of a comprehensive line of carbon steel products consisting primarily of hot rolled structural angles, beams, and channels, ingots, blooms, slabs, billets and merchant wire produts such as nails, staples, mats, netting, fencing, and welded wire fabrics.

Since its founding in 1879, the company has been solely in the steel business and has evolved into the eleventh largest steel producer and the largest mini-mill in the United States with the capability of producing 2.5 million tons of steel annually. At its single Sterling-Rock Falls facility, the company employs approximately 2,850 employees within two distinct divisions. The Steel Division produces steel exclusively through the electric arc furnace method. The company's major raw material is steel scrap from agricultural, industrial, automotive, and railroad sources. Through a series of reduction mill processes, the division produces structural beam, channel and angle products for shipment to steel service centers, steel fabricators and industrial and agricultural machinery manufacturers. The Wire Products Division processes rods from the Steel Division in the drawing and fabrication of nails, fence and a wide range of other fabricated wire products for sales to retail outlets, hardware wholesalers of wire products and agricultural cooperatives. Although Northwestern Steel sells to a national market, its major customer base is in the Midwest. Approximately 65-75 percent of net sales is through the Steel Division with the remaining sales coming from the Wire Products Division.

Competitive Problems Faced by the Company or Industry

The recession in the American steel industry and the start up and expansion of mini-mills in the United States substantially changed the competitive environment of Northwestern Steel and Wire Company in the late 1970s and early 1980s. Although competition in the steel industry is based on quality, cost, and service, these industry changes forced renewed attention at Northwestern on cost competition and the need to reduce the relatively high internal operating costs of its steel facility.

The United States steel industry suffered substantial losses from 1982 through 1986 as the result of reduced domestic markets for steel products and increased worldwide competition and industry overcapacity. As with other steel companies, the recession in the early 1980s quickly eroded the profitability of Northwestern Steel and Wire Company with the company posting substantial losses throughout the period. Between 1982 and 1985, the company lost in excess of $108 million with employment levels dropping from a high of 4,800 in the late 1970s to an all-time low of 1,500 in 1985. As the recession lifted in the late 1980s, Northwestern continued to face depressed and fluctuating market prices resulting from strong foreign competition and overcapacity among foreign and American mills.

During this period, Northwestern Steel and Wire Company increasingly faced stiff price competition from American mini-mills because of their combination of modern and efficient equipment, low labor costs, and advantageous geographic locations. Although the mini-mills have yet to compete directly with large integrated mills in heavy structural steel shapes, they produce most of the same products produced by Northwestern including merchant bars, light structural products, and wire products. Northwestern also expects mini-mill competition with its wide flange structural products.

Northwestern Steel and Wire Company confronts significant cost disadvantages compared to modern mini-mills. Company equipment, facilities, and raw materials are similar in many important respects to those of the mini-mills. However, the company's three electric arc furnaces are much larger than those of modern mini-mills resulting in the company's melting capacity being in a less efficient balance with its finishing capacity. The company also pays substantially higher rates for electricity than its major mini-mill competitors. Finally, employees of mini-mills are paid much lower hourly rates but receive incentive and profit-sharing bonuses based on the profitability of the company. As a result, during periods of low volume and depressed company earnings, labor costs are reduced allowing these mills to maintain significant cost advantages.

Strategic and Operational Objectives

Northwestern Steel responded to the steel recession and the increased competition from American mini-mills through a number of initiatives to improve operating efficiency and decrease costs. In 1980, Northwestern Steel and Wire initiated a five-year, $116 million modernization program which included construction of a continuous caster and the startup of a new rod mill. In addition, the rehabilitation of the caster machinery and the installation of a conveyer system, wire-drawing system and computer-driven 14 inch rolling mill also helped to reduce labor and material costs at the facility.

In an effort to reduce high labor costs, Northwestern requested wage and salary reductions from employees and instituted an early retirement program. In 1983, after an 85 day strike, union employees at Northwestern made a 22.5 percent wage concession in a five year collective bargaining agreement. In 1985, Northwestern established a financial incentive program to downsize the labor force through early retirement. Approximately 300 supervisors and hourly employees took advantage of the early retirement program, including many of the most skilled maintenance employees.

In 1985, Northwestern brought in a new management team which conducted an internal study of corporate management, production techniques, physical plant facilities, and labor force utilization in order to identify ways to further increase productivity and reduce operating costs. Based on this study, upper management instituted a substantial corporate restructuring and five-year redevelopment/expansion plan. While other steel production facilities continued to rationalize their respective steel production facilities, the company's strategy was to more fully utilize its assets in terms of furnace capacity and absorb the high fixed operating costs of the facility. The company substantially increased sales of semi-finished products of ingots, blooms, and billets in order to more fully utilize its furnace capacity. The company also continued the large capital investment program started in the early 1980s. This restructuring and expansion also included new management and production and inventory control systems and an employee involvement program which established Labor-Management Participation Teams throughout the facility. In 1985, an employee involvement program was first started in the Wire Division and was initiated in the Steel Division in 1986-87 with over 30 problem-solving teams now in operation.

The company continued efforts to reduce its labor costs. In 1988, the United States Steelworkers of America, Local 63, and Northwestern ratified a five-year agreement that resulted in an additional 7 percent wage and benefit concession in return for company stock under an employee stock ownership plan (ESOP).

In 1985, as part of its larger internal study, Northwestern Steel and Wire conducted an in-depth study on maintenance procedures and labor force utilization in an effort to reduce maintenance costs. The study underscored the high maintenance costs of the facility relative to recognized industry benchmarks. In the mid-1980s, the company was spending between 20 and 25 million on maintenace which represented approximately 30 percent of total operating costs. This was much higher than the recognized benchmarks within the steel industry. These industry benchmarks indicated that major competitors were incurring maintenance costs of between 18 and 22 percent of total operating costs. It was concluded that maintenance was one key area where the company could improve its overall competitive position in operating costs.

The study concluded that substantial cost savings could be realized by upgrading the skills of maintenance employees for working with new machinery and equipment and redesigning jobs and work procedures for skilled craft positions. New machinery and equipment required higher skills. In addition, the workforce reductions of the early 1980s and the early retirement program resulted in the loss of many skilled employees which had to be replaced. The study concluded that this upgrading and redesign would require higher and broader skills in the major craft classifications of the maintenance units.

The company concluded that maintenance employees in 11 craft positions were too narrowly specialized resulting in higher maintenance costs and longer facility downtimes. The craft classifications identified were: (1) welder, (2) millwright, (3) pipefitter, (4) crane mechanic, (5) furnace repairman, (6) brick masons, (7) carpenters, (8) electricians, (9) machinists, (10) rewinders, and (11) air conditioning servicemen. The higher maintenance costs resulted from the inability of craft workers to cross over and do related job tasks of another craft in order to initiate or complete a work order. For example, a crane mechanic often waited for a welder in order to repair an overhead crane. Many times, the welder then waited for an electrician to hook up a welding machine. This sequence of events wasted valuable maintenance staff time resulting in higher labor costs for maintenance and longer downtimes.

In 1986, in response to these problems, the company in cooperation with union representatives implemented a multicraft program for approximately 500 craftspersons at the facility. In 1983, a multicraft plan at Northwestern Steel and Wire Company had already become part of a contractual agreement between the company and the United Steel Workers Locals 63 and 3720. However, the program had yet to become fully operational. In implementing the Multicraft Program in 1986, the company set out to enable maintenance employees such as welders, millrights, and pipefitters to upgrade their skills to maintain and repair new state-of-the-art manufacturing equipment and be crosstrained in related skills. The expected returns from the Multicraft Program were expected to come mainly in lower labor costs in the company's mainteance units.

Possible Company Performance Outcome Measures

Maintenance operations at Northwestern Steel and Wire Company are organized and monitored at both the division and plant levels. The Multicraft Program was directed at maintenance employees in craft positions in both the Steel and Wire Products Divisions. The company considers these two divisions as distinct business segments and provides financial information on them separately in its annual report. There are three operating plants of the Steel Division. Plant 2 contains liquid metal producing facilities consisting of three 400-ton electric furnaces. Also located in Plant 2 are a bloom continuous caster and a strand continuous caster and a 12 inch merchant bar mill and rod train. Plant 3 consists of a 24 inch structural mill with a 14 inch merchant bar mill located in Plant 5. There are two plants in the Wire Products Division. Plant 1 consists of a wire mill with equipment for drawing, galvanizing and annealing wire and machinery for manufacturing fence, netting, nails and other wire products. Plant 4 consists of manufacturing equipment for welded wire products.

The Multicraft Program was intended to lower labor costs in maintenance units because of higher skill levels for diagnosing problems, greater flexibility in labor utilization, and related reductions in staffing requirements. The company measures labor costs through one major measure:

- **Manhours Per Ton:** Total direct labor hours of craft maintenance employees divided by tons of steel and wire products produced.

Need for Retraining and Training Objectives:

In order to implement the Multicraft Program, Northwestern Steel and Wire Company worked with supervisors and union representatives to develop a training and certification program for multicraft maintenance employees. Before the Multicraft Program, the company had not provided formal training to craft employees. The company and union operated an in-house apprenticeship program for each craft classification that required a standard on-the-job training period under the supervision of a qualified craftsperson followed by a written examination. The Multicraft Program required a complete revamping of the testing and certification of craft workers; the development of new training and test materials for the multicraft program; and, the establishment of a formal training program consisting of classroom and laboratory training as well as on-the-job training.

In 1986, company staff met with supervisors and union representatives to identify the major skill requirements for craft positions and the overall structure and content of a multicraft training program. Company staff then explored the resources available from the area vocational-technical center and the community college and requested information on available training materials from the National Education Training Corporation.

Training Program

The Multicraft Training Program was designed as a voluntary program in which craft employees could enroll in specific classes with most organized instructional activity on company conducted time. Although it was decided that the training program would be optional, the company decided to provide financial incentives for participation through a knowledge-based compensation system that would pay employees for additional skills learned through the program. Craftspersons could increase their base wage rate by gaining certified skill competencies in related crafts (See Figure 1). For example, a millwright could receive an increase in wages by successfully completing a multicraft program for a welder, pipefitter, and/or a crane mechanic. The training program was designed as a competency-based, self-paced instructional system. The system included classroom lecture accompanied by hands-on laboratory exercises, computer-based instruction, interactive video materials, and a resource center which provided individualized assistance upon request. Program courses were designed as 15-week courses involving 2.5 hours of formal organized instruction per week on company time. Additional instructional time was to be provided on workers' own time. In order to build trust among trainees, it was decided that all testing and instruction would be conducted by staff of the area vocational center and the community college on their respective campuses.

Based on this program design, the company developed a training plan and budget for a pilot phase of the Multicraft Training Program which would provide training to maintenance supervisors in both the Steel and Wire Products Divisions. The purpose of the pilot was to test out instructional approaches and materials and establish a strong foundation for the program which could be built upon in future years. The pilot project was designed to establish training courses in: (1) Blueprint Reading, (2) Beginning Welding, (3) Hydraulics, and (4) Industrial Electricity. The pilot project was designed for 50 supervisors over a 46 week period in which supervisors would be in training for 2.5 hours per week. The project budget of $131,685 included an 25 percent time instructional coordinator at the company, instructor costs for classroom/laboratory training at the Whiteside Area Vocational Center, and the purchase of computer-assisted instructional materials and other basic courseware from the National Education Training Corporation. The project budget also estimated that the company would spend an additional $287,730 in employee wages for training on company time.

Need for State Assistance

Because of the substantial costs of the pilot project and the financial condition of the company, the company decided to seek funding assistance from state training programs. Based on company interiews, it appears that state funding from the Prairie State 2000 Authority and the Department of Commerce and Community Affairs was instrumental in establishing the Multicraft Training Program. Although the company was committed to the Multicraft Training Program even without state assistance, company staff estimate that the state funding got the pilot program underway immediately and accelerated the implementation of the full training program by at least one year.

Performance Outcomes

Between 1986 and 1988, Northwestern Steel and Wire was successful in reducing labor costs in its mainteance units in both the Steel and Wire Products Divisions. The Steel Division achieved the highest cost savings with a 10.3 percent reduction in manhours per ton. The Wire Products Division achieved a 3.6 percent reduction in manhours per ton.

These improvements in labor costs were probably the result of a number of company cost reduction initiatives, including the Multicraft Program. The large capital investment in new machinery and equipment, the increased capacity utilization in Plant 2, the redesign of maintenance work procedures under the Multicraft Program, the employee involvement program, and the training program probably combined to produce these cost reductions. It appears that the training program was a critical factor in the successful implemention of the Multicraft Program which allowed the reduction of maintenance staff units and the improved efficiency in maintaining and repairing production equipment.

Training Outcomes

Between August, 1986 and June, 1988, approximately 339 maintenance employees had enrolled in the Multicraft Training Program. These employees enrolled in one of the following courses: (1) blueprint reading, (2) beginning welding, (3) hydraulics, and (4) industrial electricity. The highest enrollments thus far are in blueprint reading and beginning welding.

The only major problem encountered by the company in implementing the Multicraft Training Program has been a relatively high non-completion rate among the first craftspersons to enroll in the program. Instructors and supervisors reported that the non-completion problem was largely due to deficiencies in basic math and reading skills. After consultation with the area vocational center, community college, job service, and union representatives, the company decided to establish a program to teach basic literacy skills (math and reading) so that employees could complete the Multicraft Training Program and work more effectively within the maintenance units. A pilot project entitled Project More was recently implemented with employees entering Project More prior to enrolling in multicraft courses.

The pilot project of the Multicraft Training Program did include formal post-testing for skill competencies in the four major courses. These tests included written tests and laboratory projects. In addition, the on-site coordinator made sure that completers received on-the-job training to reinforce these skills at the facility. Based on this pilot program, the company will be preparing formal certification tests for major craft classifications and certification tests for related craft skills as part of the Master Craft knowledge-based compensation system.

The bulk of the training program involved organized instruction in highly transferrable skills. The instructional materials were provided by the National Educational Training Corporation which is a major provider of course materials to public vocational education centers and community colleges. The materials were standard courseware for training in skilled craft occupations. Most instruction centered on basic blueprint reading which is important to all skilled crafts in industrial settings. The trainees that were interviewed were convinced that they would be more employable in other companies as a result of their training. They felt that multicraft skills would be necessary in any company in the future.

During the pilot phase, the multicraft program did not include formal pre-testing of enrollees. As discussed above, the company has initiated a basic skills testing component of the program. However, formal pre-tests for the four core courses have not be proposed.

Observations

This case study is useful in understanding how crosstraining projects in the major crafts within maintenance units can be related to company / work unit performance objectives and the importance of competency measurement in training programs. Northwestern Steel and Wire Company initiated the Multicraft Program as part of a larger effort to reduce operating costs and bring the company more in line with the average maintenance costs in the industry. The multicraft training was directly related to company efforts to reduce mainteance labor costs through upgraded skills and more efficient labor utilization. The state training funds were instrumental in the implementation of the Multicraft Program. This program in conjunction with other initiatives resulted in significant cost reductions as measured through hours of labor time per ton of steel produced. The state grant also was instrumental in leveraging an expanded commitment to training at the company. The company has committed $147,000 for the program in 1989.

Figure 1

Proposed Master Craft Job Classification Increases At Northwestern Steel and Wire Company

	Welder	Pipefitter	Millwright	Cr. Mech.	JC Addition	Total JC
Welder	0	+	+	+	16 + 2 + 1 + 1	= 20
Millwright	+	+	0	+	16 + 2 + 1 + 1	= 20
Pipefitter	+	0	+	+	15 + 2 + 1 + 1	= 19
Cr. Mech.	+	+	+	0	16 + 2 + 1 + 1	= 20
Furnace Repair	+	0	0	+	17 + 2 + 1	= 20
Brick Masons	+				17 + 2	= 19
Carpenters	+				16 + 2	= 18
Electricians	+				18 + 2	= 20
Machinist	+				18 + 2	= 20
Rewinders	+				16 + 2	= 18
Air Cond. Servicemen	+				18 + 2	= 20

■ TRAINING GRANT RECIPIENT:

Pirelli Armstrong Tire Company
Hanford, California

Training Grant

Pirelli Armstrong Tire Company received a $1,375,000 training grant from the Employment Training Panel in November 1985. Under this grant, production personnel received training in quality control, safety, the handling of hazardous materials, and the operation of new equipment. Operations managers received training in the operation of a new computerized scheduling and management system. Maintenance workers received instruction in the repair of computerized equipment. Supervisors were trained in employee relations skills. Non supervisory personnel were covered in a collective bargaining agreement.

Focus of Case Study

This case study focused on the use of the state training funds in an effort to prevent a plant closing by improving the performance of the manufacturing facility. It focused on how the training funds in conjunction with other efforts to improve company performance.

Overview of Company or Industry

Armstrong Rubber Company was founded in 1912 and was incorporated under the laws of the state of Connecticut in 1940. In 1985, its principal offices were in New Haven, Connecticut.

In 1985, the company engaged in three businesses: (1) the design, manufacture, and marketing of tires and tubes; (2) the formulation, manufacture, and marketing of synthetic rubber and related products; and (3) the design, manufacture, and marketing of automotive and industrial heat transfer products.

The Pacific Coast division of Armstrong located in Hanford, California was first opened in the early summer of 1962, with the first tires being produced in December of the same year. The impetus for opening the plant came from Sears. It contributed capital and some start-up funds in order to bring one of its principal suppliers to the California market. Hanford was chosen because of its central location (it is equidistant from Los Angeles and San Francisco) and because it was at the crossroads of the railroad system. Through 1987, the Hanford plant produced over 54 million tires.

Armstrong tires and tubes were sold primarily in the domestic replacement market for use on automobiles, trucks, buses, and other vehicles. These items were sold under the Pirelli Armstrong name and associate brands, under contract to Sears Roebuck for distribution as Sears brand tires, and under the brand names of other distributors. Armstrong brand tractor tires and tubes and small industrial and garden tractor tires and wheel assemblies were sold to original equipment manufacturers.

In 1986, Armstrong Rubber Company was reorganized as a wholly-owned subsidiary of Armtek Corporation. The company entered the engineered drive systems, belts and hoses segment by acquiring for cash the assets of several automotive and industrial businesses from Dayco Corporation.

Competitive Problems Faced by the Company or Industry

In 1985, Armstrong believed that, of 13 domestic automotive tire manufacturers, it was the sixth largest in terms of the number of tires and tubes produced. Tires manufactured by Armstrong accounted for more that 7.7 percent of the total unit sales of automotive replacement tires in the United States during calendar year 1984 as reported by the Rubber Manufacturers Association, Inc.

In 1987, Armstrong reported that among the 12 domestic automotive tire manufacturers, it was the fifth largest company and accounted for more than 5 percent of the total unit sales of automotive replacement tires. Management believed that key competitive factors in the company's markets included price, product application, quality, and service.

In 1985, several factors converged to threaten the continued operation of the Hanford facility. The loss of competing tire manufacturing operations on the West Coast precipitated the demise of Armstrong local supplier network, forcing it to incur additional transportation costs for its raw materials. Another factor was that electricity costs soared, adding significantly to the company's operating expenses. In addition, the labor market grew tight, making for a costly labor force. Also, Sears Roebuck, a customer that comprised 60 percent of the Armstrong business, took significant losses on the sale of its tires primarily because it failed to serve the small car market. The result was that in 1985, Hanford personnel were given notice that the plant was to be closed unless $6 million in savings could be achieved.

Armstrong saved $3 million when the company and union agreed to wage concessions and when production was cut. Another $3.3 million was saved through a readjustment in the company's electricity rates ($1.3 million) through the shift to interruptible service, and through efficiencies gained by the addition of business and changes in work procedures ($2 million). The grant from the Employment Training Panel was tied to the efforts to make improvements in the operating efficiency of the Hanford plant.

Strategic and Operational Objectives

Armstrong strategy addressed the key competitive factors that defined the market. It was felt that in achieving $6 million in savings and by improving its quality, Armstrong would be able to compete effectively in the California market. Quality was to be improved by the imposition of a quality control program that relied on statistical process control. In addition, production efficiencies resulting in lower unit costs were to be achieved with the addition of new operating equipment (e.g., special cutters, segmented tire molds, etc.) and with better management of production operations. Maintenance costs were to be lowered through more effective and efficient use of maintenance personnel. Finally, plant management determined that the only route for adding new products would be to demonstrate that the facility could operate competitively.

Possible Company Performance Outcome Measures

The key measure of company performance was whether the company achieved a savings in excess of $6 million. The plant was threatened with imminent closure if it failed to cut its costs sufficiently.

Nevertheless, management developed other indicators of performance that were more closely associated with the specific training activities. One indicator of improved quality is reduction in loss from waste. Armstrong regularly calculated the cost of loss from waste and therefore was able to track its performance on this parameter over time. Operating improvements could be stated in terms of cost reductions, and this provided a means of tracking the association between training and operating savings.

Although Armstrong did not provide any information on changes in maintenance expenses or on machine downtime (an indicator of maintenance effectiveness), such measures are used at other companies and may be adapted to the Pirelli Armstrong case.

Management also looked for other performance improvements. It was expected that the addition of a new management information system would improve throughput and lower operating expenses by reducing the possibility of operational conflicts and by making better use of human and capital resources. These improvements were expected to improve the capacity of Armstrong Tire at Hanford to achieve a just-in-time inventory system.

Need for Retraining and Training Objectives

Armstrong management and the unions agreed that the effort to improve quality and reduce operating expenses required a radical change in the operating dynamics of the company. The most efficient means for changing the culture and routines of the facility was to teach all the workforce about the new system at virtually the same time.

Specific skills training objectives and expected levels of skills attainment were established for each area of training. In most cases, Armstrong was not able to document these objectives because much of the information was no longer available. Nevertheless, Armstrong personnel were able to describe instances of specific skills training objectives. For example, workers receiving the training for first-stage radial assembly were expected accurately to perform the required functions to complete the first-stage of assembling a radial tire. They also were expected to spot defects in first stage tires and to initiate actions that would flag the problem for a response. In another example, workers who were trained in the new data processing system were expected to perform specific data entry tasks, generate reports, and interpret the implications of results found in the reports.

Training Program

Training was developed and conducted by Armstrong personnel. Approximately 450 workers in production and other manufacturing- related occupations as well as 100 administrative and clerical workers received training. All training was managed and coordinated by the Hanford plant controller.

Curricula were developed for each division:

Division	Curricula--Course Titles
Employee Relations Division	Data processing Employee relations Hazardous wastes
Distribution Division	Safety training Quality training Division procedures Data processing Hazardous wastes Employee relations
Engineering Divisions	Management procedures Industrial engineering procedures Maintenance management skills Safety Hazardous wastes Maintenance management procedures Store room Print reading Trouble shooting Machine repair skills
Technical and Quality Control Division	Data Processing Hazardous wastes Technical/quality control procedures and techniques Employee relations
Controller's Division	Data processing Hazardous wastes Employee relations
Manufacturing	Manufacturing procedures and operations Manufacturing technologies Safety Quality Operating procedures Foreman training Data processing Hazardous wastes Employee relations

Need for State Assistance

The precarious financial position of Armstrong's Hanford plant and the requirement that the facility achieve $6 million in savings necessitated the involvement of an outside funding source, such as the state, before the retraining program could proceed. Hanford management had to prove that the cost reductions could be achieved before it would gain new investments from the parent company. Effectively, there were no available resources within the company to support the training.

Performance Outcomes

Plant management reported significant improvements along several parameters. The most critical improvement was that the Hanford plant was able to achieve $6.3 million in operating savings. Losses due to waste declined by over 38 percent between 1985 and 1987. The material preparation unit showed an operating improvement of 19 percent in 1987 over 1986 and a 3.8 percent improvement in 1988 over 1987. The overall operating improvement for the two years was 23.6 percent.

Tire assembly showed a slight reduction in operational performance. However, Armstrong added complex tire building procedures during this period. Specifically, 1987 performance was 3.2 percent below 1986 performance. Although there was a 2.1 percent gain in performance in 1988, overall performance for the two years declined by 1.1 percent.

Curing and final finish showed significant improvements over the two years. In 1987, operational performance improved by 17.9 percent and by an additional 4.1 percent in 1988. Overall, performance for these two years improved by 22.7 percent.

Across the plant, performance over the two years improved by 9.7 percent. A 7.6 percent gain was achieved in 1987 followed by a 2.1 percent gain in 1988.

Other indicators of performance improvements were reported by management although it did not quantify the results. These included a substantial cut in inventory stocks, improved process control, and improved ability to work in a just-in-time environment.

Training Outcomes

Management reported its satisfaction with the training outcomes, although there were no available data to substantiate that workers were able to perform the tasks for which they had received training. We believe that the design of the training program (i.e., classroom training followed by instructor-supervised structured on-site training) would have made possible a check and subsequent certification of the ability of the worker to perform the necessary tasks.

Wages and Earnings of Trainees

Company officials reported that average straight-time wages increased by 7.4 percent between November 1985 and February 1988. Part of the growth in wages could be attributable to the increase in piece-rate earnings resulting from the improved output of tire builders. The improvement was also due to an increase in the base wages of workers at the Hanford plant.

■ TRAINING GRANT RECIPIENT:
Rohr Industries, Inc.
Chula Vista, California

Training Grant

Rohr Industries, Inc. received three contracts from the Employment Training Panel totaling approximately $1,594,000. The first project, approved in March 1985, was to train 135 newly hired, formerly unemployed workers as structural and composite assemblers at the Riverside plant of the company. A total of 94 people were enrolled in the training program. Seventy-eight workers completed the 90-day employment retention period.

The second project, approved in January 1986, was to retrain 827 workers at the Chula Vista and Riverside plants in the manufacturing control system (MCS), and the Theodolite system (a new opto-electronic coordinate measuring system). A later amendment to the agreement reduced the number of workers to be retrained to 798.

The third project, approved in February 1988, expanded the second project to include more Rohr employees. In addition, it funded the retraining of workers in computer aided design and computer aided manufacturing (CAD/CAM). A total of 937 workers were authorized to start the retraining program.

Focus of Case Study

This case study focused on the training program conducted for the manufacturing control system. It is an example of a system of production information and material resources management that often is the basis for a request for training assistance from state programs. The training project for structural and composite assemblers was for new hires and therefore falls outside the scope of this study. The CAD/CAM training had not been completed at the time the field visits were made. Finally, the Theodolite components of both the second and third contract were not made part of the case study because this training affected relatively few workers using highly specialized equipment and skills.

Overview of Company or Industry

Rohr Industries, Inc., established in 1940, is a leading aerospace supplier providing "system integration, design, development, manufacturing and support services to the aerospace industry worldwide." Its principal products include nacelles, thrust reversers, pylons, noise suppression systems, engine components, and structures for high-temperature environments. It also manufactures motor casings and nozzles for solid rockets used in the space program. Product research and development is conducted in the areas of advanced composites and metals, high-temperature materials, acoustics, and manufacturing processes for existing and future applications. During fiscal year 1988, Rohr sales to commercial and government aerospace customers were 65 percent and 35 percent respectively.

Competitive Problems Faced by the Company or Industry

Rohr believes itself to be the leading manufacturer of nacelles and thrust reversers for commercial jet aircraft. Generally, the aircraft component industry is very competitive, with companies willing to forsake near-term profits in order to gain market share. In the case of Rohr, its principal sources of competition for market share are domestic and foreign airframe and jet engine manufacturers, including customers who own or have the right to the design and tooling of Rohr products.

In addition to competition from its customers, Rohr competes with other aircraft component manufacturers (including its own subcontractors) in terms of price, product quality, design and development capabilities, timeliness of product deliveries, manufacturing capabilities, and employee technical expertise. Other issues include the commitment of possible competitors to make components and the willingness and ability of Rohr itself to accept financial and other risks in connection with new programs. Rohr determined to make improvements on each of these fronts in order to maintain profitability while keeping or improving its market share.

Strategic and Operational Objectives

The great diversity and complexity of Rohr's products and short production runs has resulted in the manufacturing configuration of a job shop, albeit a giant one. Historically, periods of high production volume have caused Rohr to operate at levels that have been shown to be beyond optimal conditions. Inventories in some parts common to several products grew while there were shortages in other parts. Scheduling also increased during these periods, resulting in higher overtime costs and production delays. In short, either the wrong number of parts was ordered, or the correct parts came at the wrong time. Consequently, Rohr executives determined to extend the point of optimal performance by making improvements in manufacturing efficiency and throughput and by reducing inventory and carrying costs.

The manufacturing control system is a comprehensive and integrated data base system for scheduling manufacturing and ordering material. Each department in the scheduling; parts procurement and inventory; assembly, and shipping stages in the manufacturing cycle routinely adds to and draws from information stored in a central filing system. Users are guided by a series of menu-driven screens. This helps to impose discipline on all aspects of the manufacturing cycle and assures consistency of language and data among the various departments, thereby reducing the possibility of error that stems from ambiguity.

Rohr's corporate goals and objectives for the manufacturing control system (MCS) are to affect profits favorably by decreasing costs in labor, materials, and overhead; by increasing throughput or output by improving the efficiency and speed of manufacturing company-end products; and by decreasing inventory expenses through such practices as just-in-time inventory management.

The performance objectives for MCS include:

- Providing better information to decision makers. Data on all steps of the manufacturing cycle are up-to-the-minute and are presented in a consistent fashion.
- Improving plant operational efficiencies by virtue of more realistic production scheduling. Scheduling managers have nearly real-time information on manufacturing capacities. All relevant departments know what product to build, how many items should be built, what materials and parts will be required, when these parts will be needed, and when the product should be delivered.
- Improving faith in manufacturing schedules by permitting managers to identify problems before they occur. Problems that crop up should be limited to matters that go beyond procedural concerns.
- Avoiding unnecessary inventory investments because materials are ordered in time with their use.
- Improving customer service. Customers are provided with parts in a timely manner and at competitive prices. Sales and management are better able to give accurate cost quotations in making bids to customer requests.

These performance objectives may in turn be translated into specific sets of objectives for individual departments. For example:

Manufacturing Engineering. Two objectives of MCS are to improve departmental accuracy and efficiency by reducing the flow of paper through manufacturing engineering with the means to consolidate several bills of material into a single bill.

Production Control. Production scheduling is expected to be more realistic. Delays, changes in scheduling priorities and early completion of production stages result in automatic adjustments in production schedules.

Materials Resources Planners. Information regarding the material resource needs of manufacturing is expected to be available to material planners in a timely manner. The manufacturing control system is expected to improve control over inventory stock in terms of both carrying costs and waste. By ordering the appropriate number of parts so as to have them in stock at the time they are needed for production, Rohr minimizes the amount of inventory it must keep on hand. The company also avoids the loss of those items with limited storage life (e.g., special glues). Also, by limiting the amount of inventory and placing information on it in a single, integrated data base, MCS is expected to permit better tracking of component parts and materials.

Material Control. Prior to implementing MCS, material control generally would establish its own requirements for purchased parts and raw materials. This would be done independently of production control, which operated in accordance with its own requirements. By joining both units into a single data base and by subjecting them to common rules of procedure, it is expected that more accurate schedules stemming from specific production requirements will be achieved.

Finance. Expectations of MCS include better financial analysis resulting in early warning on cost problems, clearer definition of cost issues, more rapid response in resolving difficulties, and better understanding of costs per unit of production.

Master Production Scheduling. MCS is expected to make it possible to achieve quick changes in the master schedule. Inasmuch as information on schedule changes is logged on a single integrated data base, all units involved in the manufacturing cycle are able to adjust their own operations accordingly within 24 hours of the scheduling change.

Taken to the level of the individual worker, expectations of MCS include the following:

- Reduce paperwork.
- Enrich job quality by giving workers an opportunity to focus on the quality of their work.
- Give greater responsibility to each individual worker by making each one an indispensable part of the system.
- Give workers the tools to spot problems in the manufacturing cycle.

Possible Company Performance Outcome Measures

Companywide goals with respect to MCS were to increase profits by decreasing costs in labor, materials, and overhead; by increasing throughput or output through an improvement in the efficiency and speed of manufacturing company end-products; and by decreasing inventory expenses through such practices as just-in-time inventory management.

Under ideal circumstances, MCS should have the following effects:

Profits: Improved profits.

Labor: Reduction in labor unit costs.

Materials: Reduction in material costs per unit produced.

Overhead: Reduction in overhead costs per unit produced.

Output: Reduction in production time per product.

Reduction in work-in-progress inventory.

Reduction in production delays due to inadequate stock.

Reduction in delays caused by scheduling.

Inventory: Reduction in inventory holding costs.

Reduction in inventory storage volumes.

Although each of the company performance goals is measurable in theory, actual measurement is confounded by other events that have occurred at Rohr. Concurrent with the implementation of MCS, Rohr has experienced an enormous increase in customer orders, particularly in the commercial product lines. Historically, the strain of such volumes has created operational difficulties that have resulted in lowered profits and even periods of loss. Although MCS is expected to mitigate these problems, the benefits nevertheless are masked by the consequences of these pressures. In addition, with the exception of its replacement parts business, Rohr builds to customer orders. As a result of the changing nature of Rohr's products, it is very difficult to compare cost and production time performances per unit of product.

Analysis of work unit performance may occur on two dimensions. One dimension is the content of the work, i.e., are departmental personnel making better decisions? The other dimension is departmental processes, i.e., are departmental personnel able to perform their activities more efficiently? Although it is appropriate to assign work unit objectives on each dimension, it appears that one dimension will take priority over the other within a given department. To our knowledge, Rohr's upper management did not establish formal objectives for departmental change as it related specifically to MCS.

In interviews with personnel and supervisors from manufacturing engineering (the department that establishes bills of materials), we discovered that supervisors in this department had their own indicators of departmental performance that may be used to assess change associated with MCS. These indicators included delinquencies in bills of materials and accuracy in bills.

Although it not clear that supervisors in manufacturing engineering are typical of supervisors in other departments, the experience in manufacturing engineering suggests that departmental performance measures based on supervisor expectations may be developed.

Need for Retraining and Training Objectives

Rigorous adherence to MCS policies, procedures, and definitions is essential inasmuch as the introduction of erroneous information may affect adversely virtually all aspects of the manufacturing cycle. Comprehensive training of all affected employees in the use and operation of the company's proprietary MCS was required for the successful adoption of the system.

The skills training objectives and expected levels of skills attainment varied by department, by level of worker, and by phase of training. Specific skills competencies are tested in a computer simulation of the work environment. In order to qualify to perform MCS tasks, the worker must meet minimum competency standards.

Inasmuch as MCS was a proprietary system, Rohr officials assumed that there were no workers in the San Diego labor market who were proficient on the system. Conversely, there was no apparent demand in the area, other than that presented by Rohr, for workers who were able to function competently in the MCS environment.

Training Program

Training in MCS is generally computer-based in most company operations. Formal training occurs in a classroom setting. Prior to the establishment of computer-based training, the company used a lecture format. Formal instruction is followed by structured on-site training where the worker is guided in the application of MCS in daily activities.

The content of training for each functional area was developed by a team of authors and editors comprised of members from each affected department who participated in the development of MCS, staff from the human resources and management information systems departments, and staff from other Rohr departments (e.g., computer graphics). Representatives from each department were trained to serve as trainers for others in their departments.

The training program varied by department depending upon the complexity of the MCS application. Typically, the training was divided into several phases. In the first phase, the worker received general information in MCS and was introduced to the computer screens used in their departments. Within two months after training was completed in Phase I, the worker was tested to assess educational progress. However, the test was not used to screen workers for the next phase of the training process.

Phase II varied by functional area. In production control, the worker received detailed instruction and simulated work exercises in MCS. Following formal training, the worker participated in structured on-site training and served an internship that ranged between two and six months, depending on the worker's progress. At the completion of the internship period, the worker was tested by the training group. Those workers failing to meet minimum competency levels received remedial education in the substantive areas where performance had failed. The worker was retested two weeks after the completion of this remedial phase. Workers who finally passed the certification test were qualified to perform MCS tasks in production control. This resulted in promotions and pay increases.

In material control, workers were taught basic material resources planning and MCS theories. They also were taught to identify six screens that are used on a daily basis. In this phase they learned to read the planning status inquiry report.

In Phase II, workers received instruction in and achieved on-the-job mastery of specific screens followed by certification. The purpose of this stage was to teach workers to perform the scheduling work of the department. Therefore, workers learned to schedule materiel from a planning status inquiry screen and to schedule a common account. They also were given detailed instruction in the theory of material resources planning. In addition, they were taught to identify 12 screens and to learn the meanings of acronyms and common terms used with MCS.

Following Phase II, workers went to the third level of work where they learned to analyze and solve material scheduling problems. At this level, they received advanced instruction in the theory of material resources planning and were taught to identify 12 to 15 screens. Finally, they were given five problems to solve.

Implementation of MCS has occurred in commercial products and in the space program. It was phased into Rohr by commercial project within each department. Consequently, workers had to operate in two production scheduling environments as the old system was retired and the new system was put into place.

Need for State Assistance

Initial development and implementation of a conventional manufacturing resources planning system failed in 1979, in part because insufficient resources were allocated to training. In light of the critical need for all workers to perform their assigned tasks accurately and efficiently on MCS, Rohr had no choice but to train its workforce. Consequently, it was unlikely that the assistance of the state was required before training occurred.

However, company officials reported that the assistance from the state was instrumental in Rohr's decision to develop a comprehensive and well-structured training program that would be offered to every worker who would have direct contact with MCS. This speeded implementation of MCS and shortened the transition from the old scheduling system to the new one.

Performance Outcomes

The company was unable to report changes in its performance that may be associated with the implementation of MCS. Whatever effects that may have resulted from the implementation were overwhelmed by an increase in customer orders and by rapid changes in the competitive environment. Performance objectives were not established at the work-unit level. However, had such measures been established, it is probable that changes in performance could have been measured. For instance, according to estimates of supervisors in the manufacturing engineering department, the delinquency list decreased by 93 percent, and accuracy improved from 95 to 99 percent at the same time that staff doubled and volume increased by 35 percent.

Training Outcomes

Rohr conducted post-tests of all trainees to assess whether they had achieved minimal skill requirements to do their jobs. The practice demonstrates that such tests may serve as the basis for assessing skills achievement.

Observations

Rohr personnel attributed other effects to MCS beyond those that were established as performance objectives. One effect cited by material personnel is that they felt communication between departments had improved. In particular, they believed that problem solving was now an interdepartmental activity. They suggested that this change was due to the companywide use of a common language and set of facts. An associated effect was that departments began to compete for personnel who were accomplished in MCS.

Manufacturing engineering reported that the training program developed for MCS made it easier and faster to bring new hires up to productive work activities. Under the old system, it took several weeks before a newly hired worker was productive. Under MCS and through the use of computer-based training, workers became productive, albeit in a limited way, by the end of the first week on the job.

■ TRAINING GRANT RECIPIENT:

Simpson Timber Company
Korbel, California

Training Grant

Simpson Timber Company received a $186,590 training grant from the Employment Training Panel in November 1985 to retrain workers as part of the start-up of a newly remodelled sawmill in Korbel, California. The training grant was used to retrain 95 workers including both salaried and hourly workers in a comprehensive training program including supervisor's training, problem-solving, quality control, safety, and operations and maintanence training. Hourly workers receiving the training were part of a collective bargaining unit.

Focus of Case Study

This case study focused on the use of state training funds in company efforts to achieve performance improvements through the upgrading of production equipment and technology. The study addressed how these performance improvements were defined and measured.

Overview of Company or Industry

Simpson Timber Company is a subsidiary of Simpson Investment of Seattle, Washington. It is ranked among the upper 12 companies in the forest products industry and is one of the larger timber companies in the redwoods region, an area of northern California comprised in part by Humboldt, Del Norte, and Mendocino counties. The total timber holdings for Simpson are about one million acres.

Simpson is one of two timber companies in the region that is unionized. The Korbel plant produces finished redwood and Douglas fir lumber. The plant was remodelled in 1985-1986 at a cost of approximately $13 million to incorporate the newest generation of log conversion technology. The most recent re-modelling prior to the one in 1985 occurred in 1979 when the Korbel plant was transformed from an old growth log conversion plant to one that was able to run smaller, young growth logs.

Although the remodelling in 1979 was essential to the continued long-term operation of the Korbel plant, it did not go smoothly. The changes in 1979 included the elimination of some manually controlled operations and the subsequent replacement of these operations with automatic systems. However, the training was not well organized and was generally on-the-job. This contributed to a longer than expected start-up period and lower than expected levels of performance for a sustained period.

Competitive Problems Faced by the Company or Industry

Competition within the industry is based primarily on price and quality. Inasmuch as the timber industry functions generally in a buyer's market, competitive advantage is held over the long term by the company owning the greatest reserves. Its market position essentially is determined by the conversion return on its product. This return essentially is the difference between the return it would receive for the sale of the raw log and the return it would receive after converting the log to finished product.

Relative to other timber companies, the wages paid to Simpson personnel working in the mill generally are at the high end of the wage scale. In order to compensate for this difference in cost, Simpson has continued to update its technology in order to keep its unit prices competitive. This has been achieved through better utilization of raw materials, improved throughput, and a reduction in the number of production workers in the mill. However, increased reliance on sophisticated electronic and hydraulic technologies has resulted in a modest increase in the size of the maintenance crews.

The modernization in 1985-1986 occurred over a four-month period, during which the facility was shut down completely for construction. Much of the training occurred during this time.

Strategic and Operational Objectives

Overall, Simpson's strategic objective for the remodelling as stated in its manufacturing policies was "to maximize the conversion return from the log mix received on a sustained basis." According to Simpson, "this implies obtaining the highest-valued mix of products out of that log mix, converting it to lumber and chips at the lowest reasonable conversion cost, at quality standards that will make our products readily marketable. Regarding cost, it implies intelligent, responsible and effective use of the tools available and efficient utilization of wood fiber. In human terms, it implies a safe working environment with safety conscious work habits and methods. Further, it implies a well orchestrated team effort of knowledgeable, skilled individuals working together toward the same goals, as provided in the working agreement."

Simpson defined four major operational objectives for the training program:

1. To have a safe sawmill start-up.

2. To meet the start-up curve (production rate) to which the start-up team had committed.

3. To institute new manufacturing policies and procedures quickly and smoothly.;

4. To sustain over the long term a high level of overall sawmill performance.

Possible Company Performance Outcome Measures

The strategic and operational objectives implied the following performance outcome measures:

1. **Productivity**, defined as the amount of finished product produced in relation to the number of person hours required to produce it. Simpson used this measure as an indicator of machine capability and of equipment utilization. It also is used as a comparative measure with competing firms.

2. **Volume recovery (or fiber utilization)**, defined as the ratio of the volume of lumber that is produced to the volume of logs that is consumed. It is used as an efficiency measure for the conversion of log fiber into lumber. The cost of logs is normally about 75 percent of the total direct cost of manufacturing. Improved volume recovery will reduce the cost of raw material per unit of finished product.

3. **Grade yield or grade recovery**, defined as the proportion of upper grade (high quality) lumber to total product output. Grade yield is affected by the quality of the raw material, by sawing accuracy and by product damage caused by the manufacturing process. Upper grades result in the greatest conversion return.

4. **Throughput**, defined as the volume of lumber produced over a given time period from a specific volume of logs.

5. **Downtime**, defined as the amount of time that mill operations are interrupted. Downtime is affected by equipment breakdowns and by uneven production flow. The latter problem may result in mill operations "choking down" with more work-in-progress accumulating at one or more processing steps than may be accommodated efficiently.

6. **Payback**, defined as the amount of time required to achieve a return on the remodelling investment equal to that investment.

Need for Retraining and Training Objectives

As noted earlier, Simpson had accomplished a major remodelling of the Korbel plant in 1979, but had not implemented a formal training program in concert with the facility renovation. At the time, Simpson had planned to achieve a sustained level of production at 240 MBM (thousand board feet) per eight-hour shift within 52 weeks. Two years later, it still had not achieved that level of performance. Following an examination of the 1979 project, the project team for the 1985 renovation concluded that the failure in 1979 to meet start-up expectations and long-term performance projections was due to several factors, the principal ones being unforeseen problems in executing the plant design and the lack of formal training on the new equipment and in new manufacturing procedures.

In 1985, the Korbel remodelling project team resolved that the plant crew "hit the ground running" when the facility reopened after the four month hiatus. It set as its start-up target 345 MBM per eight-hour shift within 28 weeks of the beginning of operations. Simpson officials then concluded that in order to achieve this objective, production personnel would need to have a thorough understanding of the operation of the new equipment and to be trained in the new manufacturing procedures designed to improve grade yield and volume recovery. Also, Simpson officials realized that the advanced equipment installed at Korbel would require a higher sustained level of maintenance support. Consequently, the company determined that it was necessary to broaden and deepen the level of skills possessed by the maintenance staff.

Learning objectives for specific individual skills were not formally established by Simpson officials. Instead, company officials decided to rely on the operational performance of the Korbel plant as the primary means for assessing the effectiveness of training. Also, the project team made a conscious decision not to conduct a pre-training test. The reason was that the project team wanted to move its workers into training as quickly as practical with as little abstract theory as possible. In addition, the training was viewed as a means of achieving a fresh work culture at the Korbel facility. Consequently, pre-training testing was viewed as unnecessary and not cost effective.

Training Program

The company trained 95 employees through the state training grant. They included supervisors, machine operators, quality assurance people, saw filers, millwrights, and electricians. The total number of hours that a student was in training ranged from 184 hours to 570 hours including both classroom and structured, on-site training. Training for production personnel began upon their recall from layoff one week prior to plant start-up. Maintenance personnel generally were involved in the modernization project and received their training during the course of active employment.

All hourly employees were given an overview of the operating strategies and performance objectives of the new mill subsystems and machine centers. They also were given a course in creative problem-solving techniques and skills and a refresher safety course. Most hourly employees received additional training in lumber grading, operators manufacturing policies, fundamentals of lumber quality control, operators training, and the fundamentals of automated process control systems. Some hourly employees took other courses based on their particular jobs including saw filers training, optimization equipment, and maintenance training.

All salaried employees received training in the operational, maintenance, and safety characteristics of the new mill equipment and machine centers. They also received training in lumber manufacturing policies, job safety analysis techniques, and creative problem-solving techniques.

Need for State Assistance

Although Simpson generally was committed to conducting some formal training of key production personnel due to its experience in 1979 when the Korbel plant last was modernized, it had not allocated the resources for a comprehensive training program covering its entire production and maintenance teams. The availability of funds from the Employment Training Panel in fact did not predispose Simpson automatically to take government assistance and launch into such a training program. The company generally was skeptical of any form of government assistance due to the possibility that it would become entangled in bureaucratic red tape. However, Simpson accepted the State's assistance when it became clear to company officials that the additional financial resources would permit the company to extend the training to all plant personnel and that assistance did not restrict the company in the content or format of the training program.

Performance Outcomes

The company reported to the Employment Training Panel in July 1986 that the mill performed ahead of the production rate start-up curve during the entire start-up period. In the nearly four years following the opening of the facility, average annualized production was 33 percent higher than for the two years preceding closure of the Korbel facility for remodelling. Simpson also reported that the payback on company investment in the Korbel plant was achieved 25 percent sooner than budgeted originally.

Simpson also achieved its safety objective. It reported in 1986 that no one who received training sustained a serious injury within the start-up period spanning 28 weeks.

Simpson reported that its volume recovery, productivity, and production rate objectives were met within the 28 week start-up period. The average production rate target was nearly achieved in the eighth week after start-up. The labor hour productivity target of six MBF per person per shift was reached seven weeks before the end of the start-up period. The 345 MBF production rate target also was achieved on a sustained basis within the 28 weeks. (The mill currently is targeted for 420 MBF per shift.) Though harder to quantify accurately, it is believed that the volume recovery and grade yield objectives also were achieved on schedule. The project was accomplished on time and under budget.

Training Outcomes

Simpson did not assess the achievement of individual learning objectives. However, company officials were satisfied by the performance of the facility that the training was successful in meeting expectations.

One of the problems addressed by the training program in 1985-86 that had been observed in 1979 was that the earlier effort was too narrowly focused. For instance, in 1979, one worker received training in the operation of a specialized machine. Following completion of the training, the worker left for another job, leaving Simpson in the position of having to train another worker on the job. The training program undertaken in 1985-86 was designed to train production workers in the operation of several machines, giving Simpson the flexibility to assign workers to new posts as vacancies and absences occurred.

In broadening the training of its production personnel, Simpson placed greater demands on its machine vendors to provide clear instructions and training manuals on the operation and maintenance of their equipment. All equipment purchase contracts contained at least a conceptual statement requiring training follow-up. A few contracts established very detailed training specifications, including demands for written material, classroom training for maintenance staff, and hands-on instruction.

In one case, a hydraulics firm brought in a working model of its system to train the maintenance team in hydraulic circuitry and to afford it the opportunity to solve simulated problems. In another example, Simpson brought in a representative of Texas Instruments to discuss the control boards that were to be used in the Korbel plant. It followed the Texas Instruments presentation with a training program involving the person who actually designed the control system for the plant. He described the use of the device in the mill and gave a detailed accounting of each step in the control program.

■ TRAINING GRANT RECIPIENT:

Solar Turbines Incorporated
San Diego, CA

Training Grant

Solar Turbines received a $489,500 training grant from the Employment Training Panel in April 1986. The training grant was used to provide basic skills training for machinists, machinist and inspector training on NC/CNC horizontal and vertical lathes, laser machining centers, horizontal and vertical grinders, and electrochemical machines; CAD/CAM training for drafting and design personnel; and desktop publishing training for publications staff. Hourly workers receiving the training were part of a collective bargaining unit.

Overview of Company or Industry

Solar Turbines Incorporated is a wholly-owned subsidiary of Caterpillar Incorporated. Headquartered in San Diego where over half of its 4,000-member workforce is employed, Solar designs, manufactures, and installs gas turbine systems throughout the world. Solar turbines drive natural gas compressors, pumps, and generators. Solar compressor sets are specially packaged for jobs like natural gas transmission, gathering, lift, or reinjection. Generator sets are packaged for continuous duty, peaking, and standby applications. Mechanical drive sets come complete with gearboxes and are shipped ready to drive pumps for crude oil and product pipelining, waterflood assignments, or any other application that powers a rotating device.

Competitive Problems Faced by the Company or Industry

Historically, the oil and gas industry has been the primary customer for Solar. However, the slow oil market and increased competition from foreign manufacturers have prompted Solar to explore new markets and develop new products. For instance, it has marketed its systems to the waste industry as an energy recovery system. It also has sought to reduce its own unit costs by streamlining its manufacturing process. In its effort to reduce its operating costs, Solar had eliminated by 1987 approximately 300 management jobs and 200 production jobs in the San Diego workforce, which then had 3,000 workers.

Solar manufactures both standard and custom-designed turbines, pumps, and compressors. However, applications of these products in systems typically are custom-engineered to meet the specific needs of the customer. Often, it is impossible to test the system in its entirety until after it has been installed at the customer's site.

Consequently, the sale of Solar products is based on the company's reputation for high quality and reliable systems as well as its ability to solve difficult engineering design problems, its record in meeting delivery and installation deadlines, and its competitive prices. The efforts undertaken in 1986 and thereafter represent Solar's continued commitment to high quality and reliable on-time performance at a reasonable cost.

Strategic and Operational Objectives

Solar Turbines Inc. has embarked on an effort to develop the factory of the future. In this system, the basic engineering-to-design to manufacturing process is integrated fully and virtually automatically. In such a process, the product is engineered and designed on the computer in a CAD/CAM environment. The design provides manufacturing engineers with sufficient data on the product to order the necessary component parts. The design also may be converted into CNC machining instructions for use in the manufacturing process itself. Strategically, the purpose of this effort is to reduce cost, both in terms of quality and in labor, and to improve quality for its own sake.

Operationally, Solar Turbines Inc. had five objectives that were related directly to the training project:

1. Increase utilization of personnel. The company sought to increase the proportion of time that its personnel were involved in productive activities.
2. Increase flexibility. In 1981, the company combined several job classifications. However, Solar Turbines had not implemented the new classification structure. One objective was to train specialists within each classification on the other machinery within that classification.
3. Standardize operating procedures.
4. Improve quality of products.
5. Prepare production and design personnel for the next step in operational modernization.

Possible Company Performance Outcome Measures

Solar Turbines monitors quality along three parameters: value of inventory in rework; defects per 1000 conversion hours; and defect rate. Productivity is measured in throughput and just-in-time performance. Work efficiency or utilization is measured at individual, work unit, and building levels by comparing actual output to standardized expectations.

Need for Retraining and Training Objectives

Between 1982 and the time the request for training assistance went to the Employment Training Panel in 1986, Solar Turbines installed $30 million in machinery including a laser machining center, NC/CNC horizontal and vertical lathes, horizontal and vertical grinders, and electrochemical machines that drill holes in extremely hard metals. However, no organized retraining program was established for the employees. Because Solar lacked the machinists with the necessary operating skills, the company determined that its investment in machinery was underutilized. In addition, in 1981, the company successfully negotiated a consolidation of job classifications. At the time, the training began, this consolidation had not yet been implemented fully because the company had not cross-trained machinists in the operation of all equipment within their classifications.

Specific skills training objectives and expectations on the levels of skills attainment varied by machinist classification and by the pre-training skill level of the worker. Prior to training, Solar conducted an elaborate evaluation of employee skill levels. This served in part as the basis for individual training objectives and curricula. At the very least, each machinist was required to show proficiency in the operation of each machine for which he or she received training.

Solar previously had received assistance from the Employment Training Panel (the grant ended on December 31, 1986) to train 90 workers in computer assisted design and manufacturing. The grant examined in this case study was used to train six more drafting and design workers in CAD/CAM. Each worker was required to be able to perform drafting and design assignments using computer-assisted drafting terminals linked to a large data base.

Finally, up until the time of the training grant, Solar had produced its technical publications using the traditional cut and paste method from hard copy generated through the computer aided design process and word processing files. Solar purchased new Ventura desktop publishing software, and IBM-XT and Wang 380 hardware to remedy problems of unacceptable quality, long lead times, and high costs. As a consequence, eight publications personnel had to be retrained in the use of new equipment and software. Each worker was required to be able to demonstrate a basic understanding of all aspects of the process for producing technical publications using the new system and to perform the specific tasks associated with his or her position: e.g., editors/writers had to be able to electronically code their materials for access by the system; computer specialists were required to develop additional internal software necessary to link Solar's existing systems with the new software; publication specialists who created the final product had to use the system to pull all of the pieces together within the computer.

Training Program

Following a major restructuring of Solar in 1985, company management established a formal training structure to help the Solar workforce make the transition into new jobs and work locations. This structure brought together personnel from manufacturing (both salaried and hourly) and human resources. The program management also was advised by a labor/management steering committee that discussed issues such as logistics, grading procedures, and human resources development problems. This gave the program enormous credibility to the hourly workforce and established a mechanism for workers to bring their complaints and suggestions.

Following the establishment of a training management unit, Solar proceeded to train approximately 100 workers as instructors. This was done in conjunction with a community college so that those who completed the training successfully would receive their accreditation as instructors. Approximately 80 workers received their instructor credentials; 20 workers later were used as instructors in the program. Hourly workers who later taught received the top hourly rate plus a $0.25 per hour premium. Salaried workers who later taught did not receive any additional compensation. The vast majority of hourly workers who went through the instructor training have since been promoted to salaried positions.

All machinists who successfully completed training under the program received credit at an area community college under an agreement between Solar and the school. Prior to the start-up of the program, 200 machinists were subjected to a math assessment and an English and reading comprehension assessment. Workers requiring remedial assistance were offered classes at the community college; occasionally Solar offered remedial math courses at the plant. In addition, Solar invited the community college to offer a broad variety of courses on the company grounds in order to facilitate the educational efforts of its workers. In a few instances, workers were able to receive degrees through the educational programs available at Solar.

The basic classroom curriculum for machinists included industrial math, blueprint reading, basic machining, shop procedures, and inspection techniques. Machinists II and III received 500 hours of classroom work. The curriculum for structured, on-site training was formulated on a machine-by-machine basis for each work unit (e.g., small components work unit: Niigata, Cincinnati, Okuma, manual lathe, and ID/OD grinder machines). Machinists I and III received 250 hours of structured, on-site training.

The curriculum for facility design technicians was comprised of three parts: two-dimensional mechanical design in 22 hours of classroom work and 28 hours of laboratory work; three-dimensional mechanical design in 20 hours of classroom training and 38 hours of laboratory training; and advanced mechanical design in 18 hours of classroom work and 22 hours in the laboratory.

Need for State Assistance

Until 1981, Solar Turbines Incorporated operated an extensive training program staffed by six full-time employees. When it was purchased by Caterpillar Incorporated in 1981, training was decentralized among the divisions within Solar. The effect, however, was that training virtually stopped.

The commitment to renew the Solar training program was made prior to the involvement of the Employment Training Panel. However, Solar took large financial losses in 1985 and would have proceeded slowly in its training effort except that the Employment Training Panel agreed to finance the program. Management estimates that this speeded implementation of the Solar program by two years.

Following completion of the training grant, Solar reported that it added new training curricula, including a curriculum designed to train targeted individuals to succeed to key positions that will open because of retirements, separations, or advancements. In addition, Solar established a training institute using its accredited teaching staff that is providing training to employees at other San Diego companies.

Performance Outcomes

Quantitative information on the effect of Solar initiatives in the manufacturing side of its operations, including training on individual, work unit, or building performance could not be made available in time for this case study report. Company officials indicated that morale had improved in the workforce. They noted that workers appeared to be more motivated as evidenced by the number of people who pursued college degrees. Production managers reported to management that they could be more flexible in how they used the workers under their supervision.

Workers and supervisors reported that the training reinforced performance expectations and established uniform manufacturing procedures. The training also resulted in greater performance consistency across shifts. Prior to the training program, performance generally was known to drop off during the evening shifts when the more inexperienced employees typically were assigned.

Solar officials expressed satisfaction with the training provided to design and publications personnel. The company did not specifically track the effects of the conversion to CAD/CAM nor the conversion to desktop publishing.

Training Outcomes

The agreement with the community college to provide training for credit to the machinists resulted in a very detailed assessment program. Workers periodically were given paper and pencil tests in all classroom courses. In addition, all workers was assessed on their ability to actually perform the tasks for which they were trained on Solar machinery and equipment. These assessments were all made by the training instructors.

One consequence of the training program was that Solar employees found an outside market for their skills. During the course of the training funded by the Employment Training Panel, Solar and its employees were involved in a contract dispute that resulted in a strike. Two hourly employees that we interviewed as part of this case study reported that they were able to find interim employment during the strike period. They attributed their ability to find work to the credit they received for their training. They indicated that this was consistent with the experience of other workers who were on strike; those who had not participated in the training program seemed to have greater difficulty or no success in finding interim employment.

Solar management also reported that the involvement of the Employment Training Panel in the training project was instrumental in restarting the project following the strike. The involvement of the Panel gave the project credibility among Caterpillar and Solar managers. The state funding also represented a commitment on the part of the company to complete the project. Generally, without the involvement of the panel, training management speculated that the training project would not have been operated as formally, would not have involved so much classroom work, would not have been as structured, and would not have been as well organized.

■ TRAINING GRANT RECIPIENT:

Thrifty Corporation
Los Angeles, California

Training Grant

Thrifty Corporation received a training grant from the Employment Training Panel to retrain store managers and sales clerks in the operation and use of a new point-of-sale computer system. Managers were trained in the operation and maintenance of the computer system and the preparation of management reports. Clerks were trained in the operation of the computer terminals and customer service. The training grant paid for up to 172 hours of training between October 1987 and December 1988. The training program included up to 52 hours of classroom and laboratory training and 120 hours of structured on-site training at the store sites.

Focus of Case Study

The training grant provided training for Thrifty employees in 165 store locations throughout California. This case study is based on interviews with corporate management and training staff and trainees from two stores in the Los Angeles area.

Overview of Company or Industry

Thrifty Corporation has been engaged in the chain drug and discount store business since 1929, with a particular emphasis on discount policies since 1967. The company has grown from a single retail store to the operation of 653 California stores with 12,000 employees. Thrifty Corporation now operates the largest chain of drug stores in the western United States with over $1 billion in annual sales. It also operates a sporting goods chain under the trade name of Big 5. The company's drug and discount stores, which carry a broad range of general merchandise, are operated primarily on a self-service basis with centrally located checkout counters. Sales personnel are used where a product requires special expertise or customer service. Hourly employees are represented by locals of the Retail Clerks Union.

Competitive Problems Faced by the Company or Industry

Strong competitive conditions prevail in the drug and general merchandise markets in California. In the areas where Thrifty Corporation operates, there are numerous competing retail outlets of various types, including discount stores, variety stores, specialty stores, grocery stores, and drug stores, many of which are operated by large chains. Competition in the drug and general merchandise markets is based on price, product depth and quality, customer service, advertising, and convenience of store location.

In 1967, Thrifty Corporation changed its merchandising strategy and shifted toward a discount operation. However, the company faced stiff competition from large discount chains as well as supermarkets that began carrying general merchandise at discounted prices. In order to stay competitive, Thrifty Corporation found it necessary to change its merchandising strategy.

In the late 1970s and early 1980s, Thrifty Corporation shifted its strategy. It decided to maintain a commitment to discount pricing but also to differentiate its stores on the basis of customer service and convenience. The strategy put strong emphasis on lowering operating costs through improved purchasing and inventory control and improved productivity so that store personnel could devote more time to personalized customer service.

As part of this strategy, Thrifty Corporation reviewed ways to control costs and improve productivity through the introduction of point-of-sale and scanning computer technology that was being used extensively in supermarkets and large discount chain stores. Thrifty Corporation entered into an agreement with IBM Corporation to develop a comprehensive in-store computer system using an IBM minicomputer, six or more IBM point-of-sale cash registers, and two or more IBM personal computers for each store.

Strategic and Operational Objectives

In 1984, the company introduced its first point-of-sale system in 27 test stores to affirm the performance advantages provided by the IBM system. The company conducted a benefit analysis with matched stores and found that the point-of-sale system improved gross profits. This was due largely to increased sales volume and reduced standing inventory. In particular, the point-of-sale system improved price accuracy on shelves, reduced new inventory processing time, increased inventory turns, reduced staff time in price changes, reduced shrinkage due to theft, and improved productivity through more efficient employee scheduling, which allowed more time to be spent on customer service.

Based on this assessment, Thrifty Corporation began modernizing all of its stores by replacing electromechnical cash registers with point-of-sale computer systems that use bar coding, scanning devices, and automated pricing. The company planned to convert approximately 170 stores in 1988 and convert the remaining stores in the near future. In general, the company expected that the new computer system would assist its stores in implementing the new corporate strategy. The system would allow stores to improve gross profit margins by controlling inventory and personnel costs and increasing customer service.

Possible Company Performance Outcome Measures

The company expected performance improvements in terms of overall profitability of stores as well as performance improvement in areas that would result in improved profitability. Possible performance measures on profitability would be:

- **Gross Margins:** Total sales less cost of goods sold.
- **Gross Margins/Total Sales:** Total sales less cost of goods sold as a percentage of total sales.

The company expected to achieve improvements in gross margins through some combination of improvements in the following areas:

- **Inventory Costs:** Reductions in the cost of standing inventory.
- **Inventory Turns:** Reductions in the average shelf time of store inventory.
- **Shrinkage:** Reduction in store shrinkage due to accurate pricing and improved controls on theft.
- **Productivity:** Reductions in direct labor costs as a percentage of total sales.

Need for Retraining and Training Objectives

Store managers, assistant managers, and sales clerks in the 165 stores being converted to the new computer system had no prior experience with point-of-sale computer systems. These Thrifty employees had worked only with electromechanical cash registers. Most of these employees, especially sales clerks, had no prior experience with any type of computer. In addition, the new system included new types of information and reporting systems that had never been used by store employees. As a result, these employees required retraining in order to operate the new system.

The major training objectives for store managers and assistant managers were to give store employees the capability to operate and maintain the store-based computer system and generate administrative reports. The training objectives for sales clerks focused on the operation of the new computer terminals (cash registers) and customer service.

Training Program

The training program was designed to coincide with the conversion schedule for stores in California. Two weeks before the training, corporate staff installed the computer system and explained the training project to store employees. One week before training, store managers developed the training schedule, and the laboratory site for clerical training was prepared in the inventory storage area. An average of four stores was converted every week resulting in an average of 32 employees entering training each week.

Approximately 680 store managers, assistant managers, and manager trainees received a total of 172 hours of training including 52 hours of classroom and laboratory instruction and 120 hours of structured on-site training. The classroom instruction was provided for four hours per day for three days in one week at one of the district training stores. The classroom instruction provided a general introduction to the new system including an overview of the IBM system, checkout instructions, administrative manager functions, accounting procedures, terminal maintenance, controller functions, store reports, and closing procedures. The laboratory and structured on-site training designed to correspond to the classroom training so that managers could practice each required skill with the assistance of corporate training personnel. The on-site training covered five major areas: hardware features, clerk procedures, manager procedures, controller functions, and problem-solving procedures.

Approximately 640 sales clerks received a total of 146 hours of training including 26 hours of classroom and laboratory instruction and 120 hours of structured on-site training. The classroom training was provided for three hours per day for two days in one week. The classroom instruction covered an overview of point-of-sale computer systems and computer terminal components, system security, customer service, keyboarding, sales transactions, and other related clerical functions on the terminal. The laboratory and structured on-site training was conducted four hours per day five days each week for seven weeks. It was structured to correspond to the classroom training modules and included practice and demonstration activities on major clerical functions and a review of major system components and company procedures and reports.

Need for State Assistance

Thrifty Corporation converted approximately 150 stores between 1984 and 1987 with training provided to managers and sales clerks with the company's own resources. Because of limited resources and a small corporate training staff, the company was able to provide only four hours of training to managers and two hours of training to sales clerks. The company found that this limited training was not adequate to prepare most employees to operate the new system. The training funds from the Employment Training Panel provided the needed resources to expand the scope and time of the training program. It provided the resources to provide basic training to employees with no prior computer experience. It also provided resources for training staff to assist employees during the structured on-site training.

Performance Outcomes

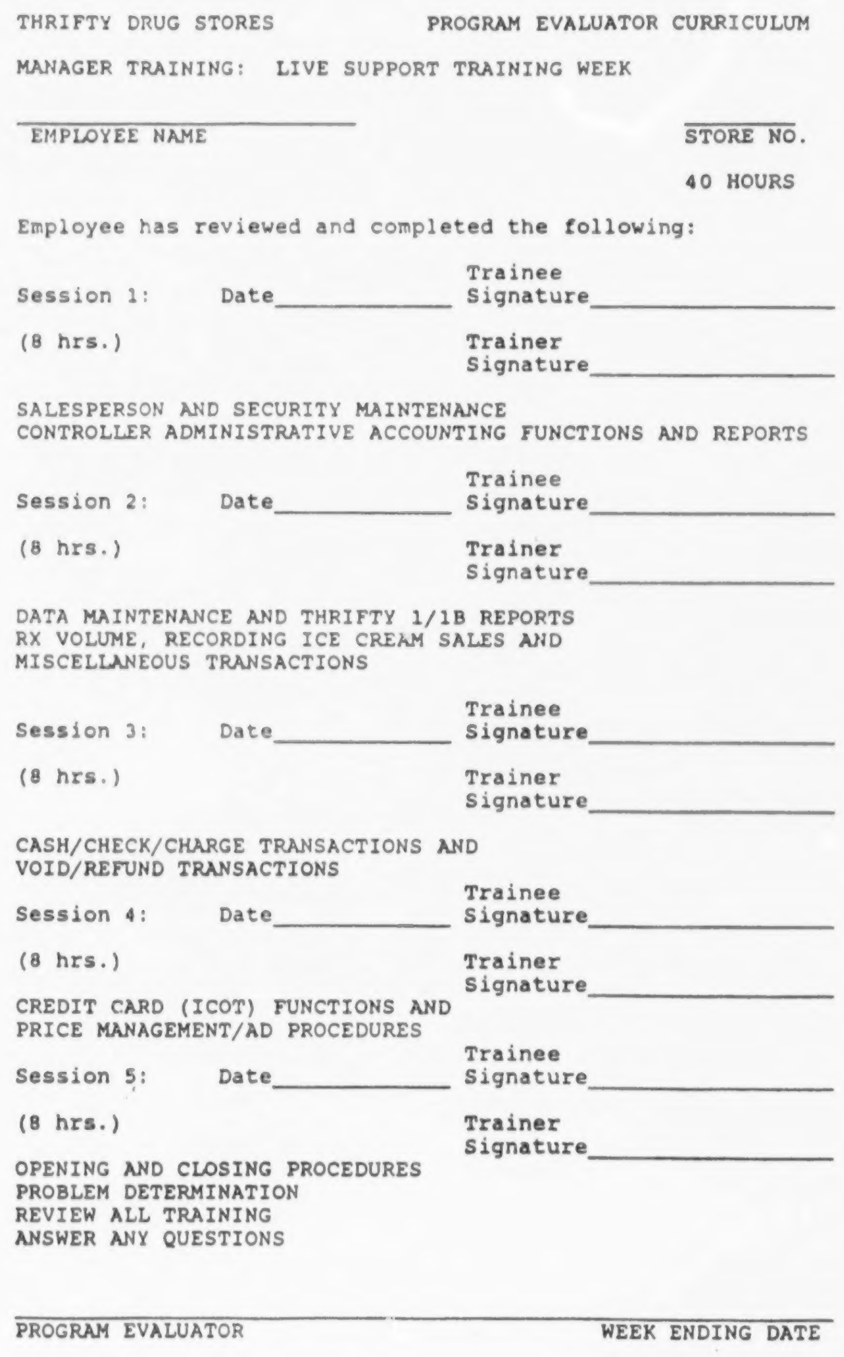
Although the company reported that the conversion to the new computer system was successful in achieving most of its performance objectives, no specific information was available from the company at the time of the case study.

Training Outcomes

The training program did not involve formal pre- or post-testing of managers or sales clerks. However, the structured on-site training component included follow-up assistance for managers and sales clerks in working with the new system. A training evaluator worked with managers and sales clerks under normal operations to make sure that they fully understood the system and could perform all required tasks. The followup forms for the training program are displayed in Figure 1.

The managers and sales clerks interviewed about the training program reported that the training program was very effective in providing them with the skills required to operate the new system. In addition, they felt that the training program gave them marketable skills that they could use in other companies because of the widespread use of point-of-sale and scanner systems in the retail trade industry in Los Angeles.

Figure 1
Program Evaluator Curriculum



THRIFTY DRUG STORES PROGRAM EVALUATOR CURRICULUM

MANAGER TRAINING: LIVE SUPPORT TRAINING WEEK

EMPLOYEE NAME ______________ STORE NO. ______

40 HOURS

Employee has reviewed and completed the following:

Session 1: Date__________ Trainee Signature______________

(8 hrs.) Trainer Signature______________

SALESPERSON AND SECURITY MAINTENANCE
CONTROLLER ADMINISTRATIVE ACCOUNTING FUNCTIONS AND REPORTS

Session 2: Date__________ Trainee Signature______________

(8 hrs.) Trainer Signature______________

DATA MAINTENANCE AND THRIFTY 1/1B REPORTS
RX VOLUME, RECORDING ICE CREAM SALES AND
MISCELLANEOUS TRANSACTIONS

Session 3: Date__________ Trainee Signature______________

(8 hrs.) Trainer Signature______________

CASH/CHECK/CHARGE TRANSACTIONS AND
VOID/REFUND TRANSACTIONS

Session 4: Date__________ Trainee Signature______________

(8 hrs.) Trainer Signature______________

CREDIT CARD (ICOT) FUNCTIONS AND
PRICE MANAGEMENT/AD PROCEDURES

Session 5: Date__________ Trainee Signature______________

(8 hrs.) Trainer Signature______________

OPENING AND CLOSING PROCEDURES
PROBLEM DETERMINATION
REVIEW ALL TRAINING
ANSWER ANY QUESTIONS

PROGRAM EVALUATOR ______________ WEEK ENDING DATE

■ TRAINING GRANT RECIPIENT:
Unicadd, Inc.
Ottawa, Illinois

Training Grant

Unicadd, Inc. received a $3,750 training grant from the Prairie State 2000 Authority to retrain five employees in computer-aided design and drafting (CAD) using CADAM, a software package increasingly used by American manufacturers. The grant was for training conducted between June 26, 1988, and March 1, 1989. The grant covered 50 percent of the instructor's salary for a total of 400 hours of training.

Focus of Case Study

The case study focused on the CADAM training for five employees at Unicadd, Inc. and the problems of small businesses in retaining retrained employees in skills that are in high demand in the local or state labor market.

Overview of Company or Industry

Unicadd, Inc. is a small engineering service and sales company with five employees. The company provides computer-aided design and drafting services to manufacturing companies. It also sells CAD-related products and provides CADAM and Autocad training.

Unicadd, Inc. was established in 1970 to furnish manufacturing companies with the contractual services of experienced designers, draftspersons, detailers, and technicians. Unicadd provides a wide range of services including product design, machine design, plant layout and maintenance, tool and die design, plastic injection molding projects, printed circuit board design, industrial design, and mechanical design and drafting. It provides services to small manufacturers and serves a broad range of large industrial clients including Pillsbury, American Hoechst, Borg-Warner Chemical, E.D.S., General Motors, Caterpillar, Union Carbide, Nabisco, and Sundstrand.

Competitive Problems Faced by the Company

Because of its wide customer base, Unicadd provides engineering design and drafting services in both CADAM and Autocad software. Most of its major industrial clients use CADAM, which is operated on mainframe computers. Autocad has traditionally held the major share of the market for microcomputers especially among small and medium-sized businesses.

In the early 1980s, Micro-CADAM, a microcomputer version of CADAM, was developed. Major industrial companies now mandate that all of their subcontractors adopt this version of make them compatible with internal engineering design and drafting operations. CADAM may therefore assume a larger share of the market among the small and medium-sized manufacturers that supply these large industrial corporations.

Strategic and Operational Objectives

Unicadd had the immediate competitive problem of shifting a large share of its contractual work to Micro-CADAM in order to retain its contracts with major industrial clients especially Sundstrand. The company projected that Micro-CADAM would eventually become a major industry standard used increasingly by small and medium-sized manufacturers.

Unicadd's major strategic objective was to retrain its employees in order to maintain current contracts with large industrial clients and begin to serve the growing market for Micro-CADAM services.

Possible Company Performance Outcome Measures

The company anticipated that it could assess the ultimate success of its retraining project by tracking sales growth and sales share in Micro-CADAM. Measures could be developed for two major performance indicators: (1) sales growth, the percentage of growth in Micro-CADAM engineering design and drafting services, and (2) sales share, the percentage of total sales in Micro-CADAM engineering design and drafting services.

Need for Retraining and Training Objectives

At the time of the retraining project, Unicadd had five employees with various levels of experience. Two were designers and three were drafters. However, none of them had any CADAM experience, and Micro-CADAM training was not available in the immediate area. The company president was the only person in the company with this experience. Because the president was involved heavily in advanced engineering design projects as well as marketing and sales, the company could not keep its contracts and successfully move into the Micro-CADAM market unless all other employees received retraining.

Training Program

Unicadd, Inc. provided a 400-hour training program to all five designers and drafters. The program involved individualized instruction and assistance with a structured lesson plan and booklet. The training was conducted using company equipment and software. It introduced employees to the CADAM system and addressed the use of the system for both engineering design and drafting. It contained eight major lesson plans: (1) Micro-CADAM introduction and orientation, (2) creating basic elements, (3) using and altering basic elements, (4) group operations, (5) using detail and analyzing geometry, (6) auxiliary views, (7) dimensioning and labeling, and (8) finishing and plotting drawings.

The training program was developed as a competency-based curriculum with training objectives and competencies defined for each lesson plan.

Need for State Assistance

Although Unicadd was growing and had strong sales projections, the company still operated at a loss. In addition, the company purchased approximately $13,000 of new software and hardware in order to remain competitive. The state assistance made it possible for the company president to devote the required time to retrain five employees in a comprehensive program.

Performance Outcomes

All five workers left the company for better jobs within six months after receiving the retraining. Although the company was able to retain Micro-CADAM contracts with the two employees who remained, it was not able to expand its sales in Micro-CADAM significantly.

Training Outcomes

The training program did not involve formal post-testing on skill competencies. However, it was organized according to clearly defined training modules with specific objectives. The company reported that all trainees were assisted until they were proficient at each goal.

Observations

This case illustrates the problems faced by small employers in retaining retrained workers. It also underscores the importance of state programs in sharing the risks taken by companies in retraining workers. Although Unicadd was not able to capture the full benefits of its retraining program, the state funds did provide increased employment and earnings opportunities for the five employees who received retraining.

■ TRAINING GRANT RECIPIENT:
United Savings Bank, F.S.B.
San Francisco, California

Training Grant

United Savings Bank received a $415,400 training grant from the Employment Training Panel in January 1990. The training grant was used to provide training to approximately 100 customer service representatives and 18 customer service supervisors on an automated customer transaction and accounting system and in sales training.

Overview of Company or Industry

United Savings Bank, F.S.B., is a federally chartered savings bank that is targeted to serve the Asian community. It is a subsidiary of First Pacific Company Limited, a public company incorporated in Bermuda and headquartered in Hong Kong. United Savings Bank, organized in 1986, is the successor to United Bank. While it was operating as United Bank, Hibernia Bank acquired it in a sale that was forced by the Federal Savings and Loan Insurance Corporation (FSLIC). At the time, Hibernia Bank was owned by First Pacific. The intervention of the FSLIC in United Bank was the result of the Banks negative worth position stemming from major losses on the retail side. Financial difficulties were exacerbated by the poor performance of the bank's mortgage operations. In 1988, Hibernia Bank was sold, but the United Savings Bank subsidiary was retained by First Pacific.

United Savings Bank is composed of two divisions. The retail banking division operates 18 branch offices in five northern California cities and five southern California communities. The mortgage loan division, acquired in 1986, operates 21 loan offices. Altogether, United Savings Bank has 39 offices in 27 California cities.

Competitive Problems Faced by the Company or Industry

The banking industry, particularly savings and loan associations, has experienced significant market upheavals due to the loosening of federal regulations and the concomitant increase in competition for customer savings to support aggressive loan portfolios. United Savings Bank and its predecessor United Bank targeted their service market as the Asian community. Prior to deregulation, the bank was able to serve the community without significant competition from other banks. However, following deregulation, United Savings Bank, although still the only major California savings institution looking to the Asian community for over half of its retail banking activities, found other savings institutions making inroads on its customer base with attractive new products. The near-failure of United Bank shook the confidence of the financially conservative Asian community. This contributed to the bank's performance problems.

United Savings Bank in 1986 began an aggressive campaign to regain its market share in the Asian community and to improve its overall financial performance. The bank developed new savings products that would appeal to the Asian community. In addition, it sought to enhance these products by offering attractive terms to its customers made possible by operational savings achieved through a reduction in transaction costs. Finally, it decided to pursue aggressively the large segment of the Asian community that traditionally operated on a cash basis and that typically did not use banks. This segment is composed primarily of older persons and new immigrants.

Strategic and Operational Objectives

The strategic objectives for United Savings Bank are like those for other savings institutions: expansion of total assets, growth in deposits, and the maintenance of capital levels that meet or exceed federal requirements. Operationally, the bank has determined that it expects at least 53 percent of its business to come from the Asian community.

In order to accomplish these objectives, the bank sought to reduce its overhead expenses by installing an automated customer transaction and accounting system in its savings branches. The system is an integrated mainframe computer network that replaced all manual and semi-automated customer account record keeping systems. The new system permits information to be entered directly on the computer. The information is verified automatically and is printed onto appropriate forms. The system is expected to decrease errors, speed transaction time, and improve customer satisfaction.

In addition, the bank determined that a large segment of the Asian market was inaccessible to traditional bank marketing approaches because of cultural tendencies that caused many older Asians and recent immigrants, primarily those of Chinese descent, to be suspicious of banks. In an effort to meet this challenge, the bank restructured some of its existing products and introduced new products. It altered its retail sales operations by redefining the function of workers with frequent customer contacts as sales and service representatives. This required that they become skilled in identifying customers' needs and in presenting the bank's products and services as solutions to customer problems. The responsibilities of bank branch supervisory staff, management staff, and mortgage loans officers were broadened to include market analysis responsibilities. They also were made responsible for setting branch goals and for improving the tracking of sales and marketing operations.

Possible Company Performance Outcome Measures

Separate performance outcome measures may be used to track the effectiveness of individual training components. Training on the use of the automated customer transaction and accounting system was expected to result in increased speed in the transaction and a reduction in errors. The gain in speed was to be achieved as bank personnel improved their proficiency in proper operational procedures and in troubleshooting problems.

The success of the bank in achieving its market objectives may be tracked at the branch level on the sale of deposit products (e.g., passbook savings, certificates of deposit, money market funds, etc.). Branch performance may also be assessed by tracking customer complaints for each branch, by questionnaires to customers, and by quality assessments performed by bank personnel posing as customers in branches where they are not known personally. Individual performance may be tracked in fee-for-service products such as traveller's checks. Sales performance at the branch and individual levels are measured against expectations. Market share assessments are not usually done for branches. Overall, market shares are calculated by the marketing department based on data that are available from the banking industry association.

Need for Retraining and Training Objectives

Although the automated customer transaction and accounting system was installed in 1985, United Savings Bank had not been able to take full advantage of its capabilities. Training on the system was conducted initially by the vendor and was limited to the performance of specific tasks. Staff was not trained sufficiently in the application of the system. Consequently, the computer network generally was underutilized.

Customer service representatives and supervisors at the completion of training were expected to be able to perform generally all customer transactions. This included routine machine operations, account inquiries, record changes, general ledger transactions, balancing and customer transactions (e.g., check cashing; savings deposit, withdrawal, transfer, update, interest, service charges, and closing; checking deposit, withdrawal, transfer, interest, adjustment, and service charges; loan payments; collection payments, principal balance adjustments).

Learning objectives for the sales training were more ambiguous. It was expected that customer representatives, new account representatives, business development officers, and mortgage loan officers would be able to demonstrate sales techniques in role-playing exercises conducted at the end of the training program. Supervisory personnel were expected to learn these skills as well as learn personnel management skills such as goal setting and performance monitoring.

Customer service representatives were expected to demonstrate a good understanding of bank products, an ability to spot sales opportunities, and courteous and professional behavior. Customer service supervisors were required to have the same skills as the customer service representatives and also to demonstrate sales leadership (e.g., sales coaching, goal-setting, feedback, sales meetings, sales observation and tracking, and sales performance assessment).

New account representatives received training specifically on techniques for selling new accounts. They were expected to demonstrate good skills in identifying customer needs, as well as the proper methods for handling questions and objections. They also were expected to demonstrate good skills in setting realistic sales goals, assessing selling skills, establishing a strategy for setting goals, and in closing the sale. Like customer service supervisors, new account supervisors received training in sales leadership. They learned how to establish their roles as sales managers, to communicate in the sales environment, to recognize and reinforce sales performance, to develop sales plans, to build sales teams, to coach sales activities, and to conduct sales meetings.

The retail sales manager was expected to perform the same functions as the new account and sales representative managers except at the branch level. Managers also received advanced training in selling skills and in prospecting for loans and deposits.

Business development officers and mortgage loan officers received training in customer prospecting. Business development officers also were expected to show a good understanding of advanced selling techniques.

Individual assessments were not conducted prior to the commencement of training. However, prior to initiating training, the performance was assessed of three branches deemed representatives of the United Savings Bank system. The results of this assessment were an important element in the assumptions underlying the design of the training program.

Training Program

Training on the automated transaction and accounting system was designed and conducted by United Savings Bank personnel. Approximately 100 customer service representatives in 19 cycles received 32 hours of classroom training, six hours of lab, and 104 hours of structured, on-site training over a 10-week period. Eighteen customer service supervisors in two cycles received 40 hours of training in the classroom, 10 hours of lab, and 96 hours of structured, on-site training over a 12-week period. This included a management unit selling course.

Sales training for new account representatives involved 24 hours of classroom instruction in three cycles, 15 hours of lab, and 84 hours of structured, on-site training over nine weeks. New account supervisors received 44 hours of classroom training, 23 hours of lab, and 104 hours of structured, on-site training in three cycles over a 14-week period. Banking retail division sales managers received 60 hours of classroom training, eight hours of lab and 148 hours of structured, on-site training in three cycles over an 18-week period. Business development officers received 40 hours of classroom training and 108 hours of structured, on-site training in three cycles over a 12-week period. Finally, mortgage loan officers received 16 hours of classroom and 88 hours of structured, on-site training in five cycles over a nine-week period.

In addition to the computer training provided by United Savings Bank personnel, sales training was done by the bank's training staff using materials developed by and purchased from Deluxe Sales Development Systems. Portions of other aspects of training, including training for the trainers, were performed by outside vendors. All training was done in English.

Need for State Assistance

Although United Savings Bank management was committed to making improvements in product sales and in lowering transaction costs, they initially were unprepared to incur substantial losses in productive staff time for the training project. Although the financial condition of the bank had improved substantially since 1986, United Savings Bank lacked the unallocated resources to implement the training program. Consequently, management support for the training project was conditioned on the financial assistance of the Employment Training Panel.

Performance Outcomes

The bank reported significant progress along several performance indicators. Average retail deposits per customer in 1989 have increased 40 percent over the previous year. This has resulted in lower processing costs and costs of funds for every dollar of deposit. In addition, profits for 1989 were expected to be as much as 25 percent above 1988 levels. At the same time, the bank has been successful in meeting all capital and net worth requirements newly instituted by the federal regulators.

Deposit growth, which increased by 40 percent overall, was spread throughout the system. Reports on four representative branches show growth rates on deposits during the first nine months of 1989 ranging from 10 percent to as much as 42 percent. Although sales training is assumed to have made a significant contribution to deposit growth, customer behavior with respect to deposits is affected by interest rate fluctuations.

Sales of fee income products such as traveller's checks increased substantially in the four representative branches. Generally, fee income during the first nine months of 1989 increased by a range of 30 to 57 percent.

Quantitative studies on the time required to complete transactions and on customer complaints were not available for this case study. However, United Savings Bank management indicated that improvements were being made in both areas.

Qualitative improvements have been achieved. Management training has resulted in the establishment of individual goals for all branch personnel, including customer services representatives. This is accomplished in individual negotiations between supervisors and workers and is consistent with upper management's push for an operation oriented toward management by objectives and performance goals that requires each worker to know his or her specific job responsibilities and service and sales goals.

Training Outcomes

Rigorous, individual assessments of workers were not conducted as part of this training program. Workers generally were assessed on their performance in role playing situations. However, this assessment was accomplished for pedagogical purposes.

Inasmuch as the training was derived from modules developed by Deluxe Sales Development Systems, United Savings Bank training staff asserted that the presence of such training on the resumes of its personnel made them much more marketable in the banking industry. There was no independent verification of this position.

Finally, United Savings Bank reported a greater willingness to finance more training, particularly as the bank further decentralizes and greater responsibilities are assigned to the branch banks. Consequently, the training financed by the Employment Training Panel is seen as an initial step in meeting the overall training needs of the business.

■ APPENDIX A
State Programs Participating in the Study

The governors of the fifty states were invited by the National Governors' Association to participate in this study to develop and test an evaluation methodology for state-financed, workplace-based retraining programs. In order to qualify for the study, it was required that the state operate a program that had funded at least six projects that provided the following:

1. The company receiving the assistance had decision-making authority over the content of training, who will provide the training, and how the money will be spent.

2. Formal skills training was provided to current employees away from the normal routines of work.

3. Training of current employees was justified because of changing skill requirements resulting from the introduction of new technology or job restructuring.

4. The purpose of training was tied directly to the clear and measurable goal of improving company performance (e.g., improving quality standards, reducing unit costs) while retraining workers.

5. Financial support of training was justified based on the expectation that, without this support, either the market position and long-term viability of the business establishment or the job security of the specific workers would be adversely affected.

6. Company-specific projects must have been funded within the last two years (1987 and 1988) and the training in these projects must be completed no later than 90 days before the end of the case study period (1989) so that outcomes could be tracked for at least 90 days as part of the evaluation study.

The Illinois Prairie State 2000 Authority and the California Employment Training Panel were selected initially to participate in the study because of the long history and extensive experience of these agencies in retraining projects. They also were key participants in the early planning of the study. Twelve of the 24 case studies were allocated to California because of the large size of the program and the breadth of funding activities; six case studies were allocated to Illinois. The remaining six case studies were divided equally between the remaining two states.

Four other states responded to the request by the National Governors' Association: New York, Missouri, Minnesota, and Massachusetts. Minnesota was not included because its response came after the deadline. Massachusetts was not selected because the program did not meet all of the criteria set forth by the National Governors' Association.

The four programs vary considerably in scope, size, project selection criteria and organizational structure. Although the missions are quite similar, each was established under circumstances that were special to its state.

California: Employment Training Panel

The California Employment Training Panel was established in 1982 to:

> **foster job creation, minimize employers' unemployment costs, and meet employers' needs for skilled workers by providing skills training to unemployment insurance claimants, recent exhaustees of unemployment insurance who have remained unemployed, and potentially displaced workers who would otherwise become unemployment insurance claimants. It is the intent of the Legislature that all training funded through this . . . . [program] result in jobs for those who successfully complete the training.**

In 1989, effective on January 1, 1990, the California legislature amended the law to provide that the legislature intends that training funded by the panel "should make a substantial contribution to the long-term job security of the trainees."

Previously, the legislature stated that its intent in establishing the Employment Training Panel was "to put unemployment insurance recipients to work by encouraging employers to locate and expand facilities in this state and training unemployment insurance recipients in skills needed by employers." The 1989 amendments to the law add that the legislature also intends the panel "to prevent unemployment by increasing productivity through the retraining of existing employees." These changes follow actual practices of the Panel in large measure inasmuch as the preponderance of the projects that it has funded have been justified on the basis of specific changes in competitive circumstances.

The panel is composed of several members. Four members of the panel are appointed by the legislature: two by the speaker of the assembly and two by the president pro tempore of the senate. Three members are appointed by the governor. The governor also designates the chair from among the members. Until January 1, 1990, the panel hired the executive director, who served at its pleasure, and staff, who are subject to the State Civil Service Act. Beginning January 1, 1990, the executive director is appointed by the governor for a term of four years. Two assistant directors are appointed by the governor. Under prior law they served at the pleasure of the panel. Under current law, they serve at the pleasure of the governor. One assistant director is required to have experience in serving the needs of small businesses, with specified duties, and the other assistant director is responsible for developing and managing the audit and compliance program of the panel.

Prior to 1990, the panel may finance projects that teach people skills that will put them to work or that teach people skills that will keep them from losing their jobs. Grants from the fund were "only for training for employers or groups of employers who assure that those who successfully complete training will be employed." In addition, the panel must have been convinced that the training will move people into careers with long-term job security. It would not, as a matter of policy, train people for "deadend, minimum wage jobs . . . [or] . . . short term or high turnover jobs." Its objective was to "help train people for good jobs that provide a decent living in stable or expanding occupations." The panel wrote performance-based contracts that tied payments to the successful completion of training and 90-day post-training retention. It reimbursed the employer for all actual training costs and reasonable administrative expenses. However, it would not subsidize wages paid to trainees or pay stipends. In the event that the workers receiving training were union members, the panel required that the union first agree to the training before state funds were expended.

The 1989 amendments provide that contracts may be made only for:

> **training in job related basic skills, including literacy skills, and job related vocational skills that are necessary for participants to attain a new job or retain an existing job with definite career potential and long-term retraining; the identification of specific industries, production and quality control techniques, and regions of the state where employment training funds would most benefit the state's economy and plans to encourage training in these areas, including specific standards and a system for expedited review of proposals which meet the standards;**

a system for giving an expedited review of proposals that are substantially similar with respect to employer needs, curriculum, duration, and costs, in order to encourage the development of proposals that meet the needs of targeted industries or geographic areas; the new standards of accountability; "the research objectives of the panel that contribute to the effectiveness of the program in benefiting the economy of the state as a whole;" and "a priority list of skills that are in such short supply that employers are choosing to not locate or expand their businesses in the state or are importing labor in response to these skills shortages. This list should identify those industries in which upgrade training is likely to encourage hiring of the unemployed on a backfill basis."

Previously, the panel was required to give priority to employers and training for employers who are "expanding their business enterprises" in California, "to employers and training for employers who are establishing enterprises in areas targeted for economic development by the [California] Department of Commerce, and to employers and training for employers in industries in which there are critical skills shortages." In addition, contracts for projects involving on-the-job training will have to specify "the specific skills and competencies to be gained as a result of the on-the-job training component of the project." Contracts for new hire training must require the contractor to provide the placement services necessary to ensure that trainees are placed in jobs for which they have been trained.

Finally, the panel is mandated to set standards of accountability for retraining contracts by no later than July 1, 1992, for all contracts (repeat contracts and larger contracts are subject to these standards effective January 1, 1991). These standards will provide that all payments will not be considered earned until the contractor shows that the training has resulted in "measurable productivity or other improvements that result in a new benefit to the California economy. The method to be used for assessing the productivity or other improvements attributable to the training shall be specified in the contract." However, the amendments essentially did not alter the basic requirement that the workers receiving retraining be retained for at least 90 days.

The 1989 amendments also provide that the Panel submit an annual plan beginning July 1, 1990. Each plan will include: "the Panel's objectives with respect to the distribution of funds between new hire training and employers in which there are critical skills shortages." The 1989 amendments require that the Panel give priority to proposals in the following order:

> 1. New hire training and retraining for workers who have received notification of actual layoff;
>
> 2. Retraining of eligible participants employed at the start of training by small businesses;
>
> 3. Retraining for workers whose jobs are threatened by increased competition form outside the state;
>
> 4. All other proposals."

The panel is required to give special consideration to proposals of new employees of firms locating or expanding in California, to new hire and retraining for firms located in enterprise zones and economic incentive areas, and to training for veterans, and to training which supports approved apprenticeship programs. The panel is mandated to provide technical assistance to encourage the development of these proposals.

Funds for the panel are derived from receipts from a tax imposed on employers. The basis for the tax is identical to California's unemployment insurance tax. Annual appropriations to the panel by the legislature have grown from $26 million in fiscal year 1983 to amounts in excess of $60 million in fiscal years 1986 through 1989. However, total revenues regularly have exceeded their annual appropriations. For example, in FY 1988, total revenues exceeded $104 million, including money carried forward from the preceding year and estimated disencumberances.

Initial panel activities were focused on projects that trained unemployed workers. However, since its inception through June 30, 1987, 53 percent of the projects have trained potentially displaced workers. Another 20 percent of the projects have combined unemployed and potentially displaced workers. The remaining 27 percent of the projects trained only unemployed workers.

Illinois: Prairie State 2000 Authority

The purpose of the Prairie State 2000 Authority is to:

> **establish employment training programs which foster job creation, reduce employer unemployment costs, and meet the needs of the economy for skilled workers by providing job-linked training for unemployment**

> **insurance claimants and potentially displaced workers who could become such claimants.**

The authority was established in 1983 under a slightly different name initially to operate a system of individual training accounts. In 1985, the mission of the authority was revised and two programs were added. One program, the Individual Training Assistance Program, was established to provide financial assistance to experienced UI-eligible workers who wanted to upgrade their skills or acquire new ones. This program was made available to workers who were unemployed as well as those who still were working. The second program, the Employer Training Assistance Program, was established "to make grants or loans to eligible employers for the purposes of providing training to employees in fields for which there are critical demands for certain skills." It also provides that the agency provide financial assistance to an employer:

> **1) who will provide job-linked training which offers special skills for career advancement or which is preparatory for, and leads directly to, jobs with definite career potential and long-term job security;**
>
> **2) who is unable to provide sufficient funds internally, or from other available sources, including Federal, State or locally administered employment and training programs; and**
>
> **3) (i) who is expanding its business enterprise in this State, is locating a new business enterprise in this State, is introducing more efficient technology into its operations which will result in greater output per employee, is expanding into new markets, or is expanding exports from Illinois, and is thereby increasing tax revenues for State and local governments; or (ii) whose existing employees are threatened with layoff unless additional training is made available to them.**

In 1989, the Prairie State 2000 Authority was authorized by the General Assembly to assist employers in the preparation of a final needs assessment and in the design of a training program. The cost of the assessment and design may be paid fully by the authority and may be made part of the final grant of training funds.

The authority is governed by a seven-member board. Four members are appointed by the governor with no more than two from the same political party. The other three members are ex officio: the state treasurer, the director of the Department of Commerce and Community Affairs, and the director of the Department of Employment Security. The ex officio members may designate others to attend meetings of the board in their place. The board elects a chair from among the four appointed by the governor. It also appoints the chief executive officer, who serves at its pleasure, and the staff.

In implementing the statute, the authority has used the Employer Training Assistance Program to assist employers to retrain their workers in new process technologies or in new forms of work organization. Pursuant to the statute, the authority requires that the employer demonstrate that it lacks the financial resources to conduct the retraining in a proper or timely fashion. Firms or establishments that are eligible for assistance include those earning little or no profits, or those reinvesting their earnings in their operations. In addition, as a condition of assistance, the authority requires that the firm or establishment making the request provide a reasonable business strategy that incorporates the proposed retraining. Like the California program, if the workers receiving the retraining are union members, the authority requires that the union first agree to the retraining before the grant or loan request may be approved. Apprenticeship and training programs that are specifically the subject of an existing collective bargaining agreement are eligible for funding under the Employer Training Assistance Program. The agency will give grants covering 50 percent of the direct training costs or low-interest loans covering all eligible costs.

Agency performance since fiscal year 1986 shows considerable year-to-year consistency. In fiscal year 1986, the authority issued 48 grants that resulted in retraining for nearly 4,000 workers. Additional grants were made to a major Illinois manufacturer under an experimental program that resulted in another 13,000 workers receiving retraining. In total, over $1 million was spent for employer training assistance. In FY 1987, the agency made 61 grant awards for over $937,000 and seven loans for over $54,000, providing training for 8,500 employees. In FY 1988, the agency made 56 grants ($927,000) and eight loans ($58,000) covering 9,735 workers.

Missouri: The Missouri Customized Training Program

The Missouri Job Development Fund was established by the 83rd Missouri General Assembly (1986) to operate two new programs: the New and Expanding Industry Training Program and the Basic Industry Retraining Program.

The New and Expanding Industry Training Program provides assistance to new or expanding industries by funding the training, retraining or upgrading of skills of potential employees. The program may also assist these industries by locating skilled employees and additional sources of job training funds. The program is funded through general state tax revenues.

Assistance may be given to industries that show that their investments relate directly to a projected increase in employment that will result in the need for training newly hired employees. It may also be given for retraining or upgrading the skills of existing employees for new jobs created by the investments of the new or expanding industry.

The Basic Industry Retraining Program, the subject of this study, is intended to provide assistance to industries in Missouri by supporting retraining and upgrading of employees skills that are required to support new capital investment. Although tied to new investment, manufacturing investment is not required to result in an increase in employment in order for the industry to qualify for assistance.

The activities that are eligible for reimbursement under either program include: the wages of instructors, regardless of who employs them; training development costs, including the cost of training instructors; training materials and supplies, including packaged training programs; travel directly related to the training program; tuition payments to third party training providers and to the industry; teaching and assistance provided by educational institutions in Missouri; on-the-job training; and lease of training equipment and space.

The program receives oversight by the Missouri Job Training Joint Legislative Oversight Committee. The committee is comprised of six members of the General Assembly. Three members are appointed by the president pro tempore and three are appointed by the speaker of the house. No more than two members for each house may be of the same political party. The committee reports to the General Assembly and the governor on all assistance to industries permitted under the law.

During fiscal year 1988, the Basic Industry Retraining Program obligated $4,678,721 (78 percent of the available combined appropriation for both the New and Expanding Industry Training Program and the Basic Industry Retraining Program) for training at 11 manufacturers. When all sources of state training assistance are considered, the total amount of funds obligated to basic industries in the context of this program was $5,892,755 during FY 1988. The Division of Job Development and Training and the Missouri Department of Elementary and Secondary Education jointly funded nine of these projects in order to meet the retraining needs expressed by the employer. Classroom training was used by eight companies; one company used on-the-job training alone; the balance of the companies used a combination of classroom and on-the-job training. The retraining assistance involved 6,529 workers.

The average grant in the Basic Industry Retraining Program was $425,338 during 1988. This amount, on average, covered retraining costs of 573 people. The average wage of each trainee was $11.72 per hour. The average private sector capital investment associated with the project was $8,812,750.

Excluding three very large project grants, one each to General Motors, Chrysler Motors Corporation, and Ford Motor Company, the average project cost was $56,124 to retrain 417 people. The average wage of workers in these eight projects was $11.07 per hour. Associated average private sector capital investment was reported to be $5,575,437.

New York: Economic Development Skills Training Program

The New York Economic Development Skills Training Program was established in 1987 in response to the challenge presented in the 1987 New York Strategic Plan for Economic Development that the state "make additional and prudent investments in skills development and worker training programs which address the immediate and future needs of private sector employers." The strategic plan also encouraged new assistance to businesses to increase their productive capacity including programs for upgrading workers' skills to enhance the application of advanced technologies. Finally, the plan pointed to the need for using education and training to address the problems of workers who face long-term unemployment and economic disadvantage because they live and work in one of the many regions in New York with declining economies.

As a consequence, the Economic Development Skills Training Program defines its mission as follows:

To assist individual businesses and industries in improving their competitiveness by providing skill training to address their human resource development needs;

To provide job skills to enable disadvantaged persons, dislocated workers, and displaced homemakers to benefit from new jobs created through economic development efforts;

To upgrade the skills of existing employees in order to assist New York companies and to modernize and improve their operations and to meet the demands of changing technologies and work environments including assistance to employees of firms involved in State financial assistance and industrial effectiveness programs;

To provide for increased training services for small businesses in the State, including new small businesses locating in economic development zones and women or minority-owned businesses.

The Economic Development Skills Training Program may make grants to local training providers, including businesses or trade associations, labor organizations, educational institutions, institutions of higher learning, community based organizations, the grant recipients or administrative entity of a service delivery area, and private industry councils established by the Job Training Partnership Act. Grants are for classroom-based training and on-the-job training.

The program is operated by a unit of the Department of Economic Development. Unlike the Prairie State 2000 Authority and the Employment Training Panel, there is no independent oversight organization or policy-setting body that governs the operation of the program. However, the statute provides that the Commissioner of Economic Development convene an Interagency Review Committee. The commissioner is chair of the committee, which consists of representatives of the New York Departments of Education, Labor, and Social Services, the State University of New York, and the Job Training Partnership Council. Project applications not less than $25,000 are to be brought to the committee for its recommendations on actions that should be taken by the Commissioner of Economic Development. Applications for less than $25,000 in assistance do not require the review of the committee.

Projects involving on-the-job training programs and labor exchange or related functions are executed and monitored by the New York Department of Labor at the authorization of the New York Economic Development Department. Classroom- based training delivered by local school districts is executed and monitored by the Department of Education. Classroom- based programs delivered by community colleges, agricultural and technical colleges, or public degree-granting institutions of higher education are executed and monitored by the State University of New York or the City University of New York, as appropriate. In addition, the Commissioner of Economic Development has created regional networks in each of the state's 10 economic development regions, involving local experts in the delivery of the Skills Training Program, to bring about greater coordination of resources and increased responsiveness to regional economic development needs and initiatives.

The statute establishing the skills training program requires that one-half of its funds must be used to provide assistance to small businesses with fewer than 100 employees. One-half of the funds must be used to provide skills training to targeted individuals (disadvantaged people, dislocated workers, displaced homemakers). Particular emphasis is given to assist minority- and women- owned firms as well as to train and upgrade the skills of women and minorities for improved employment opportunities. Program staff are required to consult the appropriate labor groups wherever there is a collective bargaining agreement in effect with an employee participating in the program. In addition, notification is given to the appropriate local Private Industry Council for any project funded in its area.

The skills training program operates with an annual appropriation from general state tax revenues of $4.4 million. The Department of Economic Development is mandated by law to work cooperatively with other agencies by sharing responsibility for training costs. Training costs include the direct cost of instruction and may include an on-the-job training wage reimbursement not exceeding 50 percent of the wage costs for a maximum of 12 weeks. Each dollar expended by the program for training must be matched by at least one dollar from other federal, state, local, or private resources. The full amount of assistance to a business may be paid to the applicant only if it has achieved its anticipated outcomes. These outcomes are defined in the project application and may specify, as appropriate, "job placement rates, number of jobs opened to targeted populations as a result of skills upgrading activities, [and] promotions or wage increases for individuals participating in skills upgrading programs." Individual businesses receiving the training also must provide a commitment to hire from among individuals who have successfully completed training.

* U.S. G.P.O.:1992-312-412:64802